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- Pressed Wood Masses for Construction of Machine Parts (Review)  
(A. I. Vigdorovich; PLASTICHESKIYE MASSY, No 11, Nov 85). 106

## ADSORPTION

UDC 541.183 + 547.245

### FEATURES OF INTERACTION OF CERTAIN DERIVATIVES OF beta-DIKETONES WITH SURFACE OF FUNCTIONAL ORGANOSILICAS

Kiev TEORETICHESKAYA I EKSPERIMENTALNAYA KHIMIYA in Russian Vol 21, No 5,  
Sep-Oct 85 (manuscript received 8 Feb 85) pp 631-634

[Article by L. A. Belyakova, T. P. Kolotusha, V. A. Tertykh and  
A. G. Maydannik, Institute of Physical Chemistry imeni L. V. Pisarzhevskiy,  
UkSSR Academy of Sciences, Kiev]

[Abstract] The range of application of finely divided silica may be broadened considerably through chemical modification of its surface. While the majority of studies on chemisorption kinetics have centered on methods employing gravimetry, IR-spectra and combinations of the two, a mass spectrometric study of the kinetics under linearly-increasing temperature appears to be promising. In essence, this method is analogous to that of thermo-programmed desorption, except that in place of the final adsorption of the reagent at the second of the three traditional stages of thermo-desorption, in this case the adsorbent is maintained under constant reagent pressure throughout the entire temperature range. This permits using high vapor pressures (up to saturation) and thus obtain kinetic data under conditions which may have practical interest. This method was employed to study hydrolysis of the methoxysilyl group on the surface of aerosil. This reaction takes place in the kinetic zone by an impact mechanism and its rate is limited chiefly by the entropic factor. Figure 1; references 13: 12 Russian, 1 Western.

12765/9835

CSO: 1841/224

STUDY OF ADSORPTION OF ORGANIC COMPOUNDS ON GOLD WITH RADIOACTIVE TRACERS--ADSORPTION OF CHLOROACETIC AND PHENYLACETIC ACIDS AND EFFECT ON IT OF CADMIUM, COPPER AND SILVER ADSORBED ATOMS

Moscow ELEKTROKHIMIYA in Russian Vol 21, No 10, Oct 85  
(manuscript received 3 May 84) pp 1363-1366

[Article by G. Khorani, V. N. Andreyev and V. Ye. Kazarinov, Central Research Institute of Chemistry, Hungarian Academy of Sciences, Budapest; Institute of Electrochemistry, USSR Academy of Sciences, Moscow]

[Abstract] Compared with platinum, gold is less active as a catalyst and the adsorption of organic compounds on its surface may therefore be less subject to destructive changes. This opens up the possibility of conducting new reactions of organic synthesis on its surface. In the present work a study was made of the adsorption of monochloroacetic and phenylacetic acids on a gilded fold electrode in acid medium employing radioactive HCl and the effects of copper, cadmium and silver adsorbed atoms. The results show that at  $E > 0.7\text{v}$  the presence of copper ions has no effect on the adsorption of organic compounds on the gold electrode. At  $E < 0.7\text{v}$ , adsorption increases. Cadmium, copper and silver present in solution have no effect on the adsorption of phenylacetic acid at those potentials where these ions are not adsorbed on a gold surface, although they do suppress phenylacetic acid adsorption at potentials where they are adsorbed. The results confirm that the radioactive tracer method is just as effective for studying gilded gold electrodes as it was for platinized platinum. Figures 4; references 19: 7 Russian, 12 Western.

12765/9835  
CSO: 1841/200

ADSORPTION FROM NON-AQUEOUS ELECTROLYTES ON ORTA

Moscow ELEKTROKHIMIYA in Russian Vol 21, No 10, Oct 85  
(manuscript received 11 Oct 84) pp 1411-1414

[Article by G. A. Kokarev, Yu. I. Kapustin and V. A. Kolesnikov, Moscow Chemical Technologic Institute imeni D. I. Mendeleev]

[Abstract] The use of oxides in electrochemical systems employing non-aqueous electrolytes such as chemical sources of electrical current and electrochromic systems of information display, is stimulating research on the structure of the electrode/electrolyte interface. In the present work, a study was made of the adsorption of both inorganic and organic compounds on ORTA from aprotic solvents in the absence of a stationary Faraday current



using radioisotopes. An ORTA film was deposited on a titanium electrode. Experimental data were obtained on the adsorption kinetics of sodium ions and hexanol; the relationship of potential to adsorption of Na and  $\text{SO}_4$  ions and hexanol in acetonitrile, dimethylsulfoxide, dimethylformamide and propylene carbonate. Additions of 0.3 - 20.0% by weight of water decreased adsorption of sodium from an acetonitrile solution of  $\text{NaClO}_4$ . The magnitude of sodium adsorption was found to be a function of the ion concentration in solution. Figures 4; references 11: 10 Russian, 1 Western.

12765/9835

CSO: 1841/200

UDC: 615.31:547.455.635].012

ANALYTIC CONTROL IN PRODUCTION OF SORBITE. PART 1. AUTOMATED DETERMINATION OF GLUCOSE BY O-TOLUIDINE METHOD

Moscow KHIKHO-FARMATSEVTICHESKIY ZHURNAL in Russian Vol 19, No 8, Aug 85  
(manuscript received 14 May 84) pp 1012-1015

[Article by T. V. Fedoseyeva, A. V. Novikov, S. V. Moskvina and S. G. Verenkina, Polytechnic Institute, Kalinin]

[Abstract] Colorimetric determination of glucose in sorbite is simple and reasonably accurate but the color produced is not stable with time and varies in intensity as a function of heating time and temperature. Automatic analyzers can standardize the analysis conditions and improve reproducibility of results. But many colorimetric methods are not suitable for automatic performance. The o-toluidine method of glucose determination is quite suitable for automatic implementation. This article describes the development of an automated method of testing glucose content of sorbite using a continuous East German automatic analyzer employing the o-toluidine method. The variation coefficient of analysis calculated for 20 parallel determinations was 1.2%, not over 5% for smaller numbers of determinations of optical density. The automated o-toluidine method suggested allows rapid and accurate determination of glucose content at concentrations of 0.001 to 50%.  
References 10: 3 Russian, 7 Western.

6508/9835

CSO: 1841/229

UDC 616-008.849.4-074+615.2/.3.033.074]:541.183.12

USE OF ION-EXCHANGE ADSORBENTS FOR DETERMINATION OF DRUGS AND THEIR METABOLITES IN BIOLOGICAL FLUIDS BY HIGH PERFORMANCE FLUIDS CHROMATOGRAPHY

Moscow FARMAKOLOGIYA I TOKSIKOLOGIYA in Russian Vol 48, No 6, Nov-Dec 85  
(manuscript received 8 Jun 84) pp 62-67

[Article by V. K. Piotrovskiy, N. N. Veyko, D. O. Rummyantsev, Yu. A. Zhirkov, A. R. Elman and V. I. Metelitsa, Institute of Prophylactic Cardiology, All-Union Cardiological Scientific Center, USSR Academy of Medical Sciences, Moscow]

[Abstract] Adsorbents with a wide range of properties can be prepared from silica gel by surface treatment with alkyl radicals; with phenyl, nitro-,

nitryl-, or amino-containing groupings; with sulfate residues; and with trialkylammonium fragments. These are typically used with phase inversion adsorbents, but ion-exchange adsorbents have advantages in the analysis of substances ionizable in aqueous solution. Experiments were conducted with cation-exchange resins partisil 10-SCX (10  $\mu$ m) and nucleosil 5-SA (5  $\mu$ m) and with phase inversion adsorbents likhrosorb RP-18 (10  $\mu$ m) and ultrasphere ODS (5  $\mu$ m). Nonachlazine and etmozine were extracted from serum with dichloromethane, but determination with phase inversion adsorbents was frustrated by accompanying lipids. However, 10-SCX selectively retained these drugs and not the endogenous lipids, allowing quantitative determinations with a sensitivity of 20 ng/ml. Verapamil and three of its metabolites were also identified in serum, urine and saliva, with sensitivities of 2-5 ng/ml; the structures of the metabolites were also determined by mass spectroscopy. Similarly, prazosin and three metabolites were identified in urine. One of the metabolites was also identified in serum. It was extracted and its structure determined. This allowed investigation of the pharmacokinetics of prazosin and identification of the metabolite as significantly contributing to its hypotensive effects. In general, ion-exchange methods are well suited to tracing drug metabolism, since biotransformation usually produces increasingly more hydrophilic substances, with a consequent sharp drop in the applicability of phase inversion methods. Biotransformation often forms polar conjugates which can relatively easily be simultaneously determined by ion-exchange methods, is illustrated by determinations of propranolol (both alone and in conjunction with prazosin) and of nadolol. Enantiomers of nadolol in serum and urine were also determined using 5-SA. In all these cases, the eluent was a mix of acetonitrile, water, diethylamine, and either phosphoric or acetic acid. Retention could be increased by decreasing the acetonitrile, buffers, or pH. Figures 4; references 13: 4 Russian, 9 Western [including 3 by Piotrovskiy et al.].

12672/9835  
CSO: 1841/256

UDC 542.61:543

#### USE OF MACROHETEROCYCLIC COMPOUNDS IN ANALYTICAL CHEMISTRY

Moscow ZHURNAL VSESOYUZNOGO KHIMICHESKOGO OBSHCHESTVA IM. D. I. MENDELEYEVA  
in Russian Vol 30, No 5, Sep-Oct 85 pp 584-592

[Article by Yu. A. Zolotov, corresponding member, USSR Academy of Sciences]

[Abstract] A review is provided of the use of sulfur and nitrogen macroheterocyclic compounds in various analytical techniques for the analysis of metal ions. Their usefulness is based on their ligand properties with respect to such ions and their selectivity in this respect. A correlated use is based on their utility as extractants. The combination of techniques that are utilized includes isolation of the metal ions by extraction, adsorption (chromatography) and electrophoresis. The concentration of the

metals is determined by standard methods of photometric analysis, as well as by fluorescent techniques, electrochemical analysis, radioanalytical, titrimetric and other methods. More recent advances in the analytical technology include the development of ion-selective electrodes based on the macroheterocyclic ligands. In addition, selected compounds have also found use as masking agents for the elimination of interfering metal ions. Figures 3; references 83: 57 Russian, 26 Western.

12172/9835  
CSO: 1841/238

UDC 632.911

#### MONITORING THE DISTRIBUTION OF CHEMICAL AND BIOLOGICAL PREPARATIONS

Moscow ZASHCHITA RASTENIY in Russian No 11, Nov 85, p 40

[Article by V. P. Lanetskiy, senior instructor, Kuban Agricultural Institute]

[Abstract] The author has developed a fluorescence instrument to monitor the distribution of pesticides and biological preparations allowing such studies to be performed during the day under field conditions and in lighted rooms. The device consists of a fluoroscope and power supply. UV radiation passes through a light filter into a dark chamber, exciting visible fluorescence in an object pressed against a 100 mm<sup>2</sup> aperture. The fluorescence is observed through a glass. Photographs are presented showing fluorescence on sample leaves which had been treated with 2, 4-D. The instrument can be used to determine the amount of drift of droplets of herbicide sprayed from aircraft. Figures 3.

6508/9835  
CSO: 1841/257

## BIOCHEMISTRY

### MICROBIOLOGICAL FOUNDATION OF BIOTECHNOLOGY

Moscow KHIMIYA I ZHIZN in Russian Vol 250, No 10, Oct 85 pp 18-22

[Article by Academician G. K. Skryabin and Ye. L. Golovyev, doctor of biological sciences: "The Microbiological Foundation of Biotechnology"]

[Text] Modern biotechnology owes its achievements to the development, on the one hand, of traditional areas of science and practice: industrial microbiology and applied biochemistry, and on the other hand, the latest sectors of physical-chemical biology, including genetic engineering. At first glance, these directions are substantially different: the first is based almost entirely on microbiological research, while it would seem that in the second area molecular biological and physical-chemical methods would play the main roles, and microbiology would be brought in only insofar as microorganisms are the objects of their application.

In fact, however, the latest branches of biotechnology, as we will try to show, are tied to microbiology just as naturally and strongly as traditional biotechnological directions.

#### Microbiology and Traditional Biotechnology

The organization about 15 years ago of large-scale industrial production of feed yeast was a major achievement of traditional biotechnology in the USSR. Today the country produces more than a million tons of this yeast annually, and in the next 10 years the microbial feed concentrates industry will undergo intensive development.

Purified paraffins from petroleum and products of acid hydrolysis of lumber, as well as methyl and ethyl alcohol (the latter is now attracting more and more attention as a promising substrate for the cultivation not only of feed yeast, but also of an edible yeast biomass) are used as the nutrient substrate in the cultivation of feed yeasts. The pure yeast biomass obtained in this process is used in animal husbandry to fortify plant fodder with protein and vitamins and is called protein-vitamin concentrate. Recently new ways have been developed for obtaining this type of feed microbial biomass, for example, industrial testing installations have already been created for the production of bacterial feed protein using natural gas and hydrogen.

In addition, work is now being carried out in the USSR to develop the production of another new type of feed of microbial origin. This involves a fundamentally different technological process, which is called solid-phase fermentation. The raw materials for this process are plant materials that can be used alone as feed, but have a low nutritional value: straw, bran, by-products from cotton and grape production and from potato and vegetable processing, and so on, that contain no more than 5 percent protein. Microorganisms capable of synthesizing cellulase, hemicellulase, and amylolytic and lignolytic enzymes are introduced into these materials: these enzymes partially "digest" the raw material polymers that are difficult to absorb, and the raw material is also enriched by the biomass of microorganisms and the biologically active substances they produce. The mixture that is obtained is used as feed. The protein content, the most valuable feed component, is between 6 and 10 percent (sawdust enriched with a fungal biomass), and can even reach 20-25 percent (potato wastes enriched with a yeast biomass).

These enriched feed preparations can be obtained two ways: intensively and extensively. Canadian researchers, for example, are following the first route: they ferment the plant raw material (treated first with a weak alkali, which partially breaks down its strongest component, lignin) in an aqueous medium using the usual fermenters. This method, however, requires that the biomass be separated from the fluid somehow and the product be dried, which makes the process very energy-intensive.

The alternative course, the extensive method, consists of cultivating microorganisms (mycelial fungi, as a rule) on a slightly moist solid substrate. This method also has a significant shortcoming: in order for the microorganisms to get enough air, the substrate layer should be no thicker than 5-7 cm, which means that the process is very materials-intensive and is difficult to mechanize.

Therefore, here at the Biochemistry and Physiology of Microorganisms Institute we are developing an intermediate version of this type of technology--solid-phase fermentation in a high layer of the substrate with artificial aeration. We have created special fermenters for this purpose that are filled entirely with the moistened substrate. The product that results resembles a "pie" made from sawdust or straw wastes and filled with fungal mycelium. We are now working on an industrial device, and there is reason to believe that this research will make it possible to create and put into production a new method for enriching plant raw materials with a microbial biomass.

The scale of production of microbial fodder preparations in the USSR is so great that we can limit ourselves to this one example to provide a graphic demonstration of the contribution of microbiology to biotechnology that is traditional in form but contemporary in content, without running the risk of downplaying the services of microbiologists and the microorganisms they study.

#### Immobilized Microbes

One of the new directions in biotechnology in which major gains have been made in recent years is the utilization of immobilized enzymes whose molecules are attached to the surface of some sort of solid material-carrier or its pores.

In our country, for example, this approach was used to develop an industrial method for the production of semi-synthetic antibiotics. However, the basic problems now facing science and practice in this area do not apply to the field of microbiology.

From the standpoint of the microbiologists, cells of microorganisms that have been immobilized in this way, live cells, or cells damaged to varying degrees, are of great interest. They can be used to transform various organic compounds, obtain many substances of practical importance (such as physiologically active preparations, intermediate products for chemical synthesis, food products, and so on), purify waste water and air, and isolate various metals from waste water and sea and river water.

In many cases the immobilized cells have obvious advantages over immobilized enzymes. The main advantages are, first of all, that the immobilized cells or aggregates of these cells retain their enzymatic activity several times longer than immobilized enzymes, and in the second place, they do not require the addition of various cofactors or electron acceptors from the outside in a reaction medium: the whole cells produce them themselves.

The physiology of immobilized cells is, in essence, a whole new field in the physiology of microorganisms, which reveals many aspects of cell biology not previously known to microbiologists. For example, it was always thought that a homogenous suspension of microbial cells in a nutrient medium was the most natural condition for the microorganisms, and the most favorable in terms of their vital activity. In fact, it is very likely that this is not a natural condition, but just the opposite, an exception, and quite a rare condition. At least a large volume of experimental data indicates that microorganisms, as a rule, feel much better when they are on some sort of solid substrate. Even when they live in water reservoirs, where it is not that easy to find a solid substrate, they gather on the surface of some sort of division, such as the water-air boundary, where they can also be considered to be immobilized in a certain sense.

From this standpoint, the fermenters commonly used in the microbiological industry, which we borrowed from chemists, are far from the ideal equipment for culturing. Indeed, in many cases cells immobilized in a gel not only continue to grow, but also show a higher level of physiological activity than those cultured in the fermenters; they form, for example, a greater biomass, which means that they make more efficient use of the growing substrates.

True, the biosynthetic activity of the immobilized cells falls off over time. It turns out, however, that if they are kept for a certain period of time in the appropriate nutrient medium, they partially renew themselves, replenish their energy stores, and seem to revive--their activity level rises again. We discovered this phenomenon in the study of the *Anthrobacter globiformis* bacterium, which can be used to turn hydrocortisone into prednisone: after 120 days of use, short incubation in a nutrient medium almost completely restored its activity level, which had fallen. This is additional confirmation of the fact that an immobilized cell should be viewed not just as a receptacle for the enzymes we need, but as a special physiological state of the microorganism, the

further study of which promises to expand significantly our current notions of the physiology of a microbial cell.

### Microbiology and Gene Engineering

Another important direction in the "new biotechnology" is the use of recombinant strains of microorganisms obtained using gene engineering methods for the production, for example, of enzymes, hormones, vitamins, amino acids, and so on.

Cooperation between microbiology and gene engineering is still not close enough to consider its contribution to this field of biotechnology significant. We must acknowledge that contemporary microbiology, with its predominantly population ecologico-physiological approach, in some instances has not been prepared for an invasion by molecular-biological methodology, which in essence is not a descriptive, but an engineering methodology.

At the same time, there is an obvious need for cooperation between specialists in these two fields. Any gene engineer doing practical work is constantly encountering, for example, significant differences in the expression of cloned genes: the yield of the product of this type of gene can range from several percent to 50-60 percent of the total cell protein. What determines these variations in the level of expression of a cloned gene?

Many physiological factors can play a role here, and they are still not being given enough attention in gene engineering. For example, supersynthesis of a product of a cloned gene, especially in a growing culture, can compete with the normal intermediate exchange of the host cell for building material for synthesis, that is, for nucleotides and amino acids. In addition, the possibilities of the protein-synthesizing apparatus in the host culture growing under ordinary conditions can turn out to be simply inadequate for the required level of expression of the cloned gene. Finally, supersynthesis of a given product can require additional generation of energy by the cell.

In other words, supersynthesis of a product of a cloned gene should be coordinated with the exchange of substances in the host cell, both in terms of the flow of energy, precursors, and cofactors, and in terms of the mechanisms that regulate these flows. Therefore, the most important task in the physiology of microorganisms today, in joint research with genetic engineers, enzymologists, and mathematicians, is to study regulatory mechanisms that form the foundation for the coordination of cell metabolism.

There are other tasks in gene engineering that in essence would be impossible to resolve without the help of microbiology. An example can be seen in the creation of microorganisms, using gene engineering techniques, that have an elevated productivity in the synthesis of a biomass. Here the experimenter should clarify exactly which biochemical reaction or metabolic sequence, and what regulatory mechanism determines or limits the overall level of metabolism, and thus the kinetic parameters of microbiological synthesis.

There is no doubt that such bottlenecks in metabolism exist. Evidence of this can be seen, for example, in the work of the West German researchers D. Strauss



and G. Hoffman, which has become widely known among microbiologists; they studied the adaptation mechanism of a bacterium to the utilization of malic acid (malate) as a source of carbon and energy. The initial culture as a whole grew poorly in a medium with malate; however, individual cells appeared in the culture that grew rapidly, and it was determined that their DNA contained repetitions of a certain segment of the genome, which taken altogether formed one-third of a chromosome. This strain synthesized several times more protein that could carry malate than the wild strain; probably in this case the process of transporting malate was also a bottleneck that hindered adaptation.

Attempts by genetic engineers to obtain similar rapidly growing mutant strains using their own means have not yet been successful. An example of this is the work of English researchers from the "ICI" firm who tried to reduce the cell's unproductive consumption of ATP which was not tied directly to the synthesis of a microbial mass in order to increase the efficiency in the growth of the *Methylophilus methylotrophus* methylotrophic bacterium growing in methyl alcohol and used to obtain a feed biomass. This bacterium has one peculiarity: it absorbs ammonium from the environment using a glutamine synthetase enzymatic system, and glutamine synthetase requires ATP to operate. The researchers replaced this system with a glutamate dehydrogenase system that does not require ATP, thinking that the reserve of ATP that was freed up would be used by the cell for growth. Indeed, this method made it possible to obtain a yield of biomass that was 4-7 percent higher than in the original strain. But is this a lot or a little? And what sort of result can a genetic engineer expect in general in experiments of this nature?

Research in the physiology of microorganisms shows that their potential possibilities are much higher than usual. For example, we found that the *Candida didensii* yeast, which has a one-generation growing time of at least 80 minutes when cultured under normal conditions and in the usual medium, after 1000 hours of "training" (culturing under specific conditions) is capable of growing at a rate that is almost 5 times faster: 17 minutes per generation! Up until now this sort of growing rate has been observed only in procaryotes, such as intestinal bacilli. Apparently, this unheard of growth rate in eucaryotes is the result of reorganization of the cell's entire metabolism: but it is still not known exactly which regulatory mechanisms make this reorganization possible.

The examples cited here show that the level of our knowledge in the physiology of microbial cultures and the metabolic organization of microorganisms--the main objects of gene engineering (even those studied the most, such as *E. coli* bacteria and *Bacillus subtilis*, or *Saccharomyces cerevisiae* yeast)--is still far from what is needed for fruitful collaboration between microbiology and gene engineering.

#### Microorganisms in Geotechnology

According to the International Union of Practical and Applied Chemistry, only technological processes in the chemical, food, and medical industries are considered areas of application for biotechnology. This places unwarranted restrictions on the sphere of biotechnology, the future of which is certainly

tied to development beyond the limits of these sectors, and in geotechnology in particular.

Of all the various directions in biotechnology, the most theoretical background and practical experience has been gained in the utilization of microorganisms for the extraction of nonferrous metals, uranium, and gold by leaching them from poor ores or ores that are difficult to concentrate using other means.

Our country is successfully developing biogeotechnological approaches to the resolution of another important problem--reducing the level of methane in the atmosphere at coal mines. Bacteria that carry out intensive oxidation of methane into carbon dioxide and that are capable of developing in very simple mineral nutrient media are used for this purpose. In order to reduce the content of methane in the coal mine, a suspension of these bacteria is either pumped into the coal bed through a well system, or it is applied in the form of a living filter on the surface of the rock in areas that are being worked. Numerous experiments have shown that under coal mine conditions these microorganisms oxidize 60-70 percent of the methane in 2-4 weeks, which significantly reduces the danger of explosions in mines that have a large level of methane, and makes it possible to intensify the extraction of coal considerably. This method has already undergone practical testing and is ready for practical introduction.

The use of microorganisms and their metabolites to increase the yield of petroleum at oil fields is a very interesting and promising field of biogeotechnology. Extensive research in this area is now being carried out in practically all petroleum-producing countries and is aimed primarily at finding surface-active substances produced by microbes, detergents, and thickeners for water pumped into the petroleum bed. In addition, scientists in the USSR are developing methods for regulating the activity of microorganisms directly in the petroleum bed. The idea is to pump oxygen or air into the petroleum bed and activate microbes that oxidize the petroleum hydrocarbons into fatty acids. This, in turn, creates the conditions for greater vital activity in the bacteria that produce methane. If this method makes it possible to increase gas-formation processes directly in the bed, then there can be a substantial reduction in the petroleum's viscosity, an increase in the pressure on the bed, and an increase in the degree of extraction.

Microbial biogeotechnology is a young field of knowledge that is an integral, but quite distinctive, part of general biotechnology. We already know quite a lot about the physiological features of geochemically important microorganisms and about their zones of distribution in various ecosystems. In recent years there has been a noticeable rise in work on modelling natural microbiological processes under laboratory conditions. However, not enough attention is being given to the study of the quantitative aspect of the activity of microorganisms under natural conditions, and to factors that affect the activity of individual units of microbial communities. Gains in basic research on the physiological and biochemical properties of microorganisms will determine to a significant extent future achievements in biogeotechnology.

Everything that has been said here leads us to the conclusion that successful development of biotechnology is possible only with intensive and specially

focused work to create a microbiological foundation for the engineering of microbial cells and communities, which should include cell biology, the biology of ecosystems, and mathematical modelling of biological systems.

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DETERMINATION OF TRANSFER RATE CONSTANTS OF HYDROPHOBIC CATIONS THROUGH  
BILAYER LIPID MEMBRANES AND COMPARISON OF CATIONS WITH HYDROPHOBIC  
ANIONS

Moscow ELEKTROKHIMIYA in Russian Vol 21, No 10, Oct 85  
(manuscript received 10 Nov 83) pp 1325-1330

[Article by Yu. A. Shchipunov and G. Yu. Drachev, Institute of Chemistry,  
Far Eastern Center, USSR Academy of Sciences, Vladivostok]

[Abstract] The kinetics of ion transport from bilayer lipid membranes is currently studied by some variant of the relaxation method. However, this method is limited due to the differences in transfer rates of oppositely-charged ions through the membrane at different stages. In the present work a method is proposed for finding the coefficient of distribution of hydrophobic ions between the surfaces of a lipid film and the bulk volume of aqueous solution from data on the adsorption of salts in the interface of two immiscible liquids filled with phospholipid molecules. These coefficients and the rate constant for different charged ions are used to calculate the potential jump at the membrane/aqueous solution interface. Figures:5; references 14: 4 Russian, 10 Western.

12765/9835  
CSO: 1841/200

## CATALYSIS

UDC 549.674:542.936.73+542.952.173+547.593.2

### CATALYTIC PROPERTIES OF CAUCASIAN ZEOLITES

Yerevan ARMYANSKIY KHIMICHESKIY ZHURNAL in Russian No 9, Sep 85 pp 595-596

[Article by M. N. Kostandyan, S. G. Babayan, M. R. Musayev and K. G. Mirzoyeva, Yerevan Department of Inorganic Materials of the All-Union Scientific-Research Institute of Chemical Reagents and Ultrapure Chemical Substances, Azerbaijan Academy of Sciences Institute of Petrochemical Processes, Baku: "Study of the Catalytic Properties of Natural Zeolites of the Caucasus. Part 2"]

[Excerpt] Great deposits of natural zeolites have been discovered in the Caucasus which can be used in various fields of the economy. One promising direction of using them may be the field of petrochemistry.

Report (1) presented the results of research on the conversion of 1-hexanol in natural zeolites in the Caucasus. This work was carried out in order to obtain comparative data on the catalytic activity of zeolites from the following deposits: Novyy Kokhb in Armenia, Ay-Dag in Azerbaijan, and Khekordzula in Georgia. This established that without any preliminary chemical treatment these zeolites are good catalysts for the dehydration of primary hexyl alcohol and the isomerization of the 1-hexene obtained into 2-hexene. The activity of all three catalysts is almost identical.

Continuing the research in this direction, our work studied the conversion of cyclohexanol in the same natural zeolites. The conditions for carrying out the experiments and methodology of obtaining the reaction products are presented in (1). The results of the experiments are presented in the table.

The data obtained show that the degree of dehydration of cyclohexanol at low temperatures (250-350°C) is significantly greater than the degree of dehydration of 1-hexanol. The dehydration is accompanied by skeletal isomerization into 1- and 3- methylcyclopentenes (a total of 3 percent).

At high temperatures (400-450°C), along with an increased degree of isomerization of cyclohexene into methocyclopentenes, the formation of methylcyclopentane is observed as a result of the redistribution of hydrogen and coke on the catalysts.



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UDC: 661.566.4:66.097.322

COMMERCIAL OPERATION OF 2-STAGE AMMONIA OXIDATION CATALYST IN COMBINED UNITS  
UNDER PRESSURE OF 0.716 MPa

Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 11, Nov 85 pp 670-671

[Article by A. Ya. Kantor, N. V. Dobrovolskaya, M. M. Karavayev,  
N. F. Kleshchev, V. M. Miniovich, I. I. Gvozdetskiy and N. I. Goloborodko]

[Abstract] The experience which has been gained in the use of 2-stage catalysis with nonplatinum type KM2T thermally stable catalyst as the second stage in UKL-7-69 units in a shop for producing nonconcentrated nitric acid at the "Azot" Production Association in Cherkassy is discussed. After introduction of 2-stage catalyst at the plant, the ammonia charge per unit and degree of conversion remained at the same level as when platinum catalyst alone was used. Introduction of the 2-stage catalyst has resulted in a significant savings of capital investment and reduction in nonrecoverable losses of platinum. The economic effect of the introduction of the 2-stage catalyst is 500,000 rubles. Figure 1; references 7 (Russian).

6508/9835

CSO: 1841/213

UDC: 66.097.322.011:661.961.621

METHOD OF ESTIMATING SELECTIVITY AND PREDICTING HYDROCARBON CONVERSION  
CATALYST TRAVEL TIME

Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 11, Nov 85 pp 651-652

[Article by E. G. Arveladze, V. P. Semenov, K. B. Veselovskiy, T. N. Soboleva,  
L. A. Rudnitskiy and A. M. Alekseyev]

[Abstract] A description is presented of methods of estimating selectivity of hydrogen conversion catalysts. The purpose of the work was to determine the relationship between selectivity and running time of the catalyst. A number of industrial and laboratory specimens of hydrocarbon conversion

catalysts were studied on an installation designed for the study of the process of vapor-phase conversion of liquid hydrocarbons and a laboratory thermogravimetric installation for determination of the quantity of carbon liberated on a catalyst in a stream of methane and CO<sub>2</sub>. The raw material was straight-run gasoline, BP=100-140°C. After evaporation in a coil, it was mixed with hydrogen and sent to catalytic sulfur purification, then mixed with water vapor and sent to the hydrogen conversion reactor through another coil. The greatest running time was that of ICI catalyst which operated for 230 hours total. The least running time was GIAP-3 and GIAP-8 catalyst. Catalysts with longer running times have smaller quantities of carbon liberated on them when tested in the thermogravimetric installation. Figure 1; references 5: 4 Russian, 1 Western.

6508/9835

CSO: 1841/213

UDC 541.138.3

#### EFFECT OF SURFACE PROPERTIES OF ACTIVATED CHARCOAL ON KINETICS OF ELECTROREDUCTION OF OXYGEN

Moscow ELEKTROKIMIYA in Russian Vol 21, No 10, Oct 85  
(manuscript received 20 Sep 84) pp 1384-1387

[Article by I. A. Kukushkina, G. V. Shteynberg and A. V. Dribinskiy, Institute of Electrochemistry imeni A. N. Frumkin, USSR Academy of Sciences, Moscow]

[Abstract] It has been reported that the nature of surface groups (functional) present on active charcoal has an effect on the catalytic and electrocatalytic properties of the charcoal. Thus, the electrocatalytic activity of charcoal in oxygen reduction in sulfuric acid is higher over a "basic" charcoal than over an "acid" charcoal. In the present work a study was made of the effects of modifying activated charcoal KM-2 on the reaction kinetics of the electrochemical reduction of oxygen in acid and base electrolytes. Polarization curves for oxygen reduction in 1N KOH and H<sub>2</sub>SO<sub>4</sub> indicate that an optimum ratio of basic to acidic surface groups exists at which the charcoal has maximum electrocatalytic activity. Figure 1; references 9: 6 Russian, 3 Western.

12765/9835

CSO: 1841/200



## BASIC METHODS OF PRODUCING ACTIVE ALUMINUM OXIDE

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA  
KHIMICHESKIYE NAUKI in Russian Vol 15, No 5, Sep-Oct 85  
(manuscript received 1 Aug 84) pp 110-119

[Article by V. A. Dzisko and A. S. Ivanova, Institute of Catalysis, Siberian  
Department, USSR Academy of Sciences, Novosibirsk]

[Abstract] When aluminum oxide is used as a catalyst or carrier for catalysts, rigid requirements must be placed on maximum content of such impurities as sodium, iron and silicon. Active aluminum oxide is primarily produced by heat treatment of the hydroxide, prepared by various methods. The most important of these are methods based on its precipitation from solutions of salts and thermal decomposition of alumina hydrate. This article presents a study of the basic principles at the foundation of the technology of production of aluminum oxide, attempting to estimate the suitability of these methods for various areas of application. The attempts of some researchers to create a universal technology for the production of aluminum oxide are not desirable. It is better to use two technologies. For a catalytic process harmed by the presence of sodium or silicon dioxide, aluminum oxide should be used which is obtained by reprecipitation, allowing synthesis of a high purity product. For adsorption processes insensitive to such impurities, aluminum oxide should be produced by thermal dispersion. This eliminates the need for careful washing of the product in this process, preventing formation of contaminated waste water. This greatly simplifies and reduces the cost of the product. References 41: 38 Russian, 3 Western.

6508/9835  
CSO: 1841/235

UDC: 547241

## INTERPHASE CATALYSIS IN SYNTHESIS OF PHOSPHINES

Yerevan ARMYANSKIY KHIMICHESKIY ZHURNAL in Russian Vol 38, No 9, Sep 85  
(manuscript received 24 May 85) pp 582-590

[Article by R. A. Khachatryan, S. V. Sayadyan, and M. G. Inikyan,  
Armenian Affiliate, All-Union Scientific Research Institute of Chemical  
Reagents and Highly Pure Chemical Substances, Yerevan]

[Abstract] In 1981 the authors developed a convenient method for producing tertiary phosphines, based on interphase catalysis. It was established that diphenyl phosphine can be successfully alkylated by allyl type halides in an aqueous alkaline medium in the presence of an organic solvent and

catalytic quantities of catamine AB forming diphenyl-2-alkynyl phosphines. Somewhat later, another convenient method of alkylation of phosphines was developed by performing a reaction in a super basic medium, also eliminating the use of alkali metals. This article compares these two methods in the synthesis of both saturated phosphines and phosphines with allyl groups. The studies showed that saturated halides can be successfully used for alkylation of diphenyl phosphine in a 2-phase catalytic system. The yields of diphenyl ethyl, diphenyl propyl, and diphenyl butyl phosphines in the aqueous alkaline medium in the presence of catamine AB were 80, 89 and 84%. The optimum conditions for alkylation of diphenyl phosphine by allyl and alkyl halides in interphase catalysis are: temperature 60-65°C, reaction time 3 hours, organic solvent tetrahydrofuran, catalyst catamine AB. References 3 (Russian).

6508/9835

CSO: 1841/227

## CHEMICAL INDUSTRY

### DEVELOPMENT OF SIBERIAN CHEMICAL INDUSTRY

Moscow KHIMIYA I ZHIZN Vol 250, No 10, Oct 85 pp 2-7

[Article by Vladimir Vladimirovich Listov, member of the editorial board of KHIMIYA I ZHIZN and USSR minister of the chemical industry: "Main Storehouse, Most Important Shop"]

[Text] Siberia is the main storehouse of our natural resources. Its petroleum and coal, gas and mineral and chemical raw materials, its immense hydroelectric and timber reserves are being drawn more and more actively into the national economy. Many leading sectors of the economy, including the chemical industry, are being developed on an accelerated basis in Siberia; the main storehouse is becoming one of the most important shops. Chemistry will play an important role in the economic transformation of this immense region. The editors have asked Vladimir Vladimirovich Listov, member of the KHIMIYA I ZHIZN editorial board and USSR minister of the chemical industry, to discuss the development of this sector in Siberia.

At the dawn of Soviet power, in 1918, a difficult year for the young republic, V. I. Lenin described the prospects for utilizing the natural resources of Siberia and the Far East, and stressed: "The development of these natural riches using the latest technology will form the foundation for unprecedented progress in productive forces" (V. I. Lenin, "Poln. sobr. soch. [Complete Collected Works], Vol 36, p 188).

Adhering consistently to this course, the party is focusing constant attention on the accelerated development of productive forces in Siberia, utilization of its natural resources, and building up its economic potential. In the years of Soviet power immense natural riches have been discovered in the eastern parts of the country and have been developed to serve the national economy. A huge amount of work has been done. But a great deal still remains to be done.

There are plans to mine an unprecedented quantity of minerals between the early 1980s and the year 2000. The center of practically all raw materials mining activities will be shifted conclusively to Siberia, which is being developed in accordance with scientifically based, large-scale plans. The "Siberia" program

has been in effect for several years already; it is an intersectorial complex of research studies which should form the scientific foundation for effective exploitation of Siberia's natural riches and for the development of its productive forces.

The All-Union Conference on the Development of Siberia's Productive Forces, which was held in Novosibirsk in July of this year, was devoted to the resolution of these problems in the 12th Five-Year Plan and beyond. Participating in the conference were V. I. Vorotnikov, member of the Politburo of the CPSU Central Committee and chairman of the RSFSR Council of Ministers; heads of ministries and departments, party workers, leading scientists, and organizers of production. The conference participants outlined specific ways to intensify industry in Siberia based on accelerated development of scientific and technical progress in light of the decisions of the April (1985) Plenum of the CPSU Central Committee and the June meeting on issues involving the acceleration of scientific and technical progress that was held by the Central Committee.

At the Plenum and the June conference M. S. Gorbachev, general secretary of the CPSU Central Committee, outlined the fundamental tasks involving technical retooling of the national economy, accelerated development and introduction of new technology and equipment, and improvements in product quality. The successful fulfillment of these goals depends to a great extent on the accelerated development of basic sectors of industry that determine the pace of scientific and technical progress in the country as a whole. The chemical industry is one of these basic sectors.

The Siberian chemical industry is developing at an accelerated pace. The necessary conditions for this development are present: first--raw materials, and second--energy.

In terms of its structure and economic aspects the chemical industry is one of the most energy-intensive sectors. We need only to cite a single figure: today the industry utilizes about 42 million tons of standard fuel from our fuel and power resources. The energy demands of the chemical industry are constantly growing.

Siberia is a land of inexpensive fuel and electrical power; considering the immense distances, it is technically complicated to transport these resources to the European part of the country, and in a number of cases, it is economically unsound. The development of a major chemical industry in Siberia helps resolve to a certain extent the critical problem of conserving raw materials and energy resources, making more efficient use of these resources, and reducing the energy consumption involved in the production of various goods.

During the years of Soviet power some large chemical enterprises and plants have been built in Siberia and they produce a wide range of products, from photographic paper, reagents, and other products of small-scale chemistry, to large-scale products, such as mineral fertilizers, sulfuric acid, polymer materials, caustic soda, and so on. Giants of the chemical industry are still being built, such as the Tomsk and Zima chemical plants and the Omsk plastics

plant. New capacities have been put into operation for the production of mineral fertilizers, plastics, synthetic resins, and chemical fibers at enterprises in the Kemerovo industrial center. The production of synthetic fibers in Barnaul is being expanded, as is the production of artificial "siblon" fibers in Krasnoyarsk Kray.

We are now moving toward development of the East on an unprecedented scale. Here is a fact that confirms this: in a 15-year period, beginning with the 12th Five-Year Plan, the funds allocated for the development of the chemical industry in Siberia will exceed the total previous allocations several-fold. These funds will be used primarily for the construction of large enterprises, and for the reconstruction, expansion, and technical retooling of existing plants.

Today Siberia accounts for almost 10 percent of the entire commodity production of the Ministry of the Chemical Industry and 13.5 percent of the total value of fixed industrial and production capital under the ministry.

By the year 2000 Siberian chemical industry enterprises will account for a significantly larger share of the total output of enterprises in the sector.

The time is not far off when Siberia will become the country's largest producer of polymer products. In the 12th, 13th, and 14th five-year plans there are plans to introduce large new capacities for the production of high and low-pressure polyethylene, polypropylene, polystyrene, and polyvinyl chloride. The increase in the production of these products in Siberia will be higher than the increase throughout the sector as a whole. By the end of this century there will be a sharp rise in the contribution of Siberian plants and combines to the national production of plastics and synthetic resins, especially polyvinyl chloride.

In recent years major changes have taken place in the production structure of chemical fibers and threads. The production of super-strong synthetic threads is rising, and new fibers are appearing that have prescribed properties for industrial purposes. Their production is noticeably shifting to the eastern part of the country. The possibility of making extensive use of petroleum refining products creates the necessary conditions for the future development of new fiber and thread plants.

The chlorine industry plays an important role in Siberia's chemical industry. It should be noted that the production of caustic soda in Usolye-Siberskoye and Kemerovo was organized some time ago. There are plans for the further development of this subsector in the next few years, especially in the eastern part of the region. The chlorine industry is one of the most energy-intensive sectors in the chemical industry. In Eastern Siberia there is an exceptionally fortunate combination of rich fuel, power, and water resources and large reserves of the main raw material for the chlorine industry--table salt (including the Usolsko-Bulaynin, Zima, Bratsk, Kanarayskoye, and other deposits). In addition, major consumers of products of the chlorine industry are located in Siberia and the Far East--other chemical plants, petroleum refining plants, petrochemical enterprises, and pulp and paper plants.

There will be a significant increase in the output of chlorine products, and caustic soda in particular, at Siberian enterprises.

The development of many chemical plants, and other plants as well, is now tied to methanol, which is to a certain extent a chemical product of tomorrow. Methanol can be used as a component of motor fuels, as an intermediate product in the production of fuels, or as a fuel additive, and so on. In the next 15 years the production of methanol in Siberia will also undergo accelerated development.

Small-scale chemistry will be expanded in the region, which includes the production of reagents, especially pure substances, and dyes. The local picture here is one of construction regions that are nearly uninhabitable and often difficult to reach, long, harsh winters, permafrost, and a lack of any developed infrastructure. This predetermines the form of organization of industrial production--the creation of large territorial complexes and industrial centers that have at their disposal large power resources, vast reserves of raw materials, and all the necessary conditions for people to live and work.

These centers include the Western Siberian, Angarsk-Zima-Usolye, and Kansk-Achinsk complexes. The Kemerovo, Omsk, Tomsk, Tobolsk, and other industrial centers have already been built as part of these complexes. In each of them the development of all sectors of industry pursues the main goal of complete utilization of all natural resources--both power and raw materials resources--to ensure the most efficient and thorough processing of raw materials right up through obtaining commodity production.

This form of organizing production is especially effective for the chemical industry, with the wide range of methods used to process natural raw materials, broad assortment of products, and abundance of by-products and waste products. What's more the chemical industry, in increasing the economic efficiency of production in the region, can be and already is becoming the basic core of industrial centers, both as an intermediate link in the complex chain of processing natural materials, and as the final stage in this process.

Consider, for example, the Kemerovo industrial center. It includes the large "Azot" [Nitrogen], "Khimprom" [Chemical Industry], and "Karbolit" [Carbolite] associations, a chemical fiber plant, and an aniline dye plant. This large center of the chemical industry produces a considerable share of fibers, phenol-formaldehyde and ion exchange resins, caprolactam, synthetic dyes, spirits, and mineral fertilizers. Even from this list, which is far from complete, it is clear that the chemical industry here can provide the necessary raw materials for agriculture and many machine building sectors.

In the future it will be possible for the Kemerovo center to cooperate with the Tomsk center: ethylene and propylene can be sent from Tomsk along product conductors to Kemerovo. Here these products will be processed into various polymer materials and articles made of these materials. The transition to petroleum and gas raw materials, which will begin to be received from Western Siberia, will increase the economic efficiency of the plants in the Kemerovo center. Hydrocarbon raw materials will provide the foundation for the

production of new design materials with prescribed properties, which are needed in machine building and for the production of consumer goods.

The Western Siberian complex has a great future. As already noted, the Kemerovo enterprises will undergo further development, the construction of the Tomsk chemical plant will be continued--with capacities for the production of ethylene, propylene, benzene, polyethylene, polyacetal and carbamide resins, and formalin. The production of plastifiers and ion-exchange resins will be organized at the Omsk plastics plant.

After 1990 there are plans to build a Western Siberian gas and chemical complex based on the ethane-containing raw materials from the Urengoy gas fields. This complex should include the creation of plants for the production of polymers new for Siberia--polyvinyl acetate and polyurethane polymers.

The basic goals for the development of the Angarsk-Zima-Usolskiy complex are to increase the output and expand the assortment of chlorine products. At the Zima chemical plant there are plans to introduce capacities for the production of diaphragm caustic soda and polyvinyl chloride resin, and at the Usolskiy "Khimprom" production association there are plans to develop plants for the production of epichlorhydrin together with chlorocarbons.

In the next decade there will be greater specialization of the center in the production of polyvinylchloride, calcium chloride, and caustic soda; the possibility is being considered of creating plants for the production of synthetic rubber, chloroparaffins, masticated rubber cable, some types of plants that use chlorine in their production, and processing of polyvinyl chloride resin into finished products.

Long-range plans for the development of the sector call for further development of enterprises in Krasnoyarsk Kray and other eastern regions. In the year 2000 the "Sibvolokno" [Siberian Fiber] plant, for example, will produce a significant share of artificial fibers in the country.

The development of chemical plants will promote more comprehensive exploitation of the natural resources in Eastern Siberia, and satisfaction of the constantly growing demands of many sectors of industry that are developing here.

Rational, carefully considered, and sound distribution of new plants is especially important for eastern regions of the country, since comprehensive utilization of resources based on modern technology and methods will make it possible not only to cover expenses tied to the specific nature of development of these regions, but will also provide a significant economic effect. In addition, concentration of industry in territorial complexes makes it possible to successfully resolve ecological problems in the region.

A great deal is being done in the sector with respect to environmental protection--from the construction of highly effective waste treatment installations to the creation of waste-free production processes. At new enterprises in Siberia ecological issues are dealt with from the very outset, and their rational resolution is part of the planning stage.

However, the chemical industry in Siberia was formed in the war and pre-war years, when many plants were evacuated to this region from the central parts of the country. At that time, understandably, environmental protection was not the primary focus, and the evacuated enterprises were put into operation without reliable waste treatment facilities. Today there must be drastic changes in this state of affairs. Just in recent years capital investments totalling 170 million rubles have been spent on the resolution of ecological problems at the sector's enterprises in Siberia.

Enterprises in the chemical industry have already learned to make quite thorough use of the waste products of polymer materials and glass fiber, used organic acids, mineral sludge, and many other products. All these wastes can be used as raw material in the production of fertilizers, building materials, and consumer goods. Cooperation among enterprises in various sectors within the framework of a single industrial complex makes it possible to fulfill this task successfully.

The sector now has an extensive program for introducing low-waste and waste-free technologies, and full utilization of secondary raw materials. Implementation of this program will mean that by the year 2000 the chemical industry in Siberia will be a waste-free sector of the national economy.

Further development and maximum intensification of the chemical industry in Siberia will be based entirely on utilization of the latest achievements in science and technology.

A specific program for the acceleration of scientific and technical progress has been drawn up in the sector. There are plans to increase capital investments earmarked for reconstruction and technical retooling up to 50-60 percent of the total in the near future. Science, and the incorporation of basic research results, will play an important role in meeting these goals.

It is with great satisfaction that I can discuss the strong contacts between the sector and the USSR Academy of Sciences and the Siberian Department of the USSR Academy of Sciences; we are drawing up plans for joint work during the next five-year plan. Interesting results have been obtained and have already been applied in industry: catalysts, new polymer materials, radiation technologies, more efficient utilization of fuel, power, and natural resources, and work in the area of environmental protection.

Today the development of basic research and the introduction of scientific achievements should proceed on a more intensive basis and should follow the basic directions for development of scientific progress in the sector. These directions include improving the quality and expanding the assortment of plastics and resins by modifying existing materials and developing new ones, by means of chemical, radiation, and structural modifications, alloying, and so on; intensification of research on reducing multiple-stage processes; research in the area of  $C_1$ -chemistry; resolution of the problem of full utilization of nuclear fuel; creation of industrial lines with a large unit capacity; increasing production reliability; mathematical modelling; automation and mechanization of production; conservation and rational utilization of raw materials, electrical and thermal resources, and so on.



We will discuss this last problem in more detail.

Greater attention must be given to the conservation of raw materials and energy resources, we must strive for a reduction in the materials and power consumed in production and in production costs at each plant and throughout the sector as a whole. There are no trivial issues in this area, and no matters that are of secondary importance. We must take a thrifty approach to precious metals that are in short supply and are used in small quantities in catalytic processes, we must regenerate catalysts, reduce consumption norms for food raw materials, process waste products, and use secondary raw materials.

Measures aimed at conservation and rational utilization of fuel and energy resources are particularly important: the introduction of progressive energy-saving technological systems at all, and I emphasize that, all chemical plants; an increase in the energy efficiency of equipment in use; the creation of combined energy cycles; improvements in cooling systems; the utilization of secondary energy resources, such as used heat; recuperation of mechanical energy of flows under pressure; and the use of highly active catalysts with increased sensitivity.

The processing of Kansk-Achinsk coal can serve as a model of an improved energy-saving integrated technology. The scheme being worked out by Siberian research scientists--power engineers and chemists--calls for the production of energy and chemical products to be combined in a single complex, full processing of all the substances found in coal, and utilization of the heat of exothermal reactions in carrying out the endothermal stages of the technological process. This complex makes it possible to obtain motor fuel and boiler fuel simultaneously, along with intermediate products for organic synthesis, and high-calorie solid fuel.

Further intensification of the chemical industry would be inconceivable without full automation of chemical production, the use of robots and robotics complexes, the development of fundamentally new machinery systems that allow flexible reorganization of production and conservation of human labor, reliable environmental monitoring systems, and the creation of shops and plants that do not require human support. These are the stages that our chemical industry, especially the rapidly developing Siberian chemical industry, will be going through, where the personnel issues are of the utmost importance.

Other problems need to be resolved as well, such as those tied to perfecting the management of territorial complexes, improvements in capital construction, the need to develop chemical machine building in the region, training of highly skilled professional personnel, keeping them on the job, and the creation of the necessary infrastructure. Resolution of these problems depends to a great extent on construction workers, machine builders, and local party and soviet organizations.

The Siberian chemical industry should change from a raw materials base that exports primary processing products to the European part of the country into a sector characterized by extensive utilization and processing of raw materials. The honorable mission of the Soviet chemical industry is to change Siberia's

role in our economy, which has been formed over the centuries, and to ensure further rapid development of the eastern parts of the country.

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CSO: 1841/248

## PRODUCTION AND RESEARCH PLANS OF PHOSPHORUS INDUSTRY

Moscow KHIMIYA I ZHIZN in Russian Vol 250, No 10, Oct 85 p 23

[Text] The Kazakh "Giprofosfor" Phosphorous Industry Scientific Research and Planning Institute has the possibility of organizing industrial production of:

Inorganic phosphorous salts (Na, K, Li, Mg, Ca, Zn, Ba, Cu, B, Al, Pb, Mo, W, Mn, Fe) of all degrees of decomposition, technical and reactive qualifications;

White phosphorus--e.p [especially pure] 9, 5 (here and below this first figure indicates the number of limited impurities in the product, the second indicates the degree of purity, that is, the number of nines after the decimal point);

Red phosphorus--analytical grade, chemically pure, e.p. 9, 5

Phosphoric anhydride (phosphorus pentoxide,  $P_2O_5$ )--analytical grade, chemically pure, e.p. 9, 5;

Phosphoric acid ( $H_3PO_4$ ), 70-80 percent  $P_2O_5$ --e.p. 13, 3

Hypophosphorous acid ( $H_3PO_2$ ) 60-65 percent--analytical grade, chemically pure;

Polyphosphoric acid ( $H_{n+2}P_nO_{3n+1}$ ), 76-78 percent  $P_2O_5$ --pure, analytical grade, e.p.

For an evaluation of the possible scale of production the institute is asking interested organizations to send information on estimated demand for these products to the following address: 486031 Chimkent, Lenin Square 3.

\* \* \*

We are seeking consumers for by-products of the electrochemical production of sebacic acid, which are a mixture of methylethers of valeric acid (about 50 percent), allyl acetic acid (about 45 percent), and ethylidene propynoic acid (about 5 percent). After initiation in 1986, industrial production of sebacic acid will provide approximately 1500 tons of these by-products per year.

All-Union Monomers Scientific Research and Planning Insitute (VNIPIM)

We are buying caprone waste (threads, pieces of line and cables, bits, rag, and so on), which the combine uses as secondary raw material in making shoe parts. Annual demand is 5 tons.

Sukhumi Multisectorial Combine of the Abkhaz ASSR Ministry of Local Industry, 384908 Sukhumi, Sportivnaya Stree 7, Tel. 2:71-16. Current account No 36620 at the Abkhaz office of the State Bank.

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UDC 678.5.003.13

CERTIFICATION OF WORK-SITES AND TECHNICAL PROGRESS IN PLASTICS

Moscow PLASTICHESKIYE MASSY in Russian No 11, Nov 85 p 3

[Article by V. M. Grigorov]

[Abstract] A countrywide certification of work sites was being carried out aimed at improved utilization of production funds and labor resources. During the last year, preparatory work was underway: selection of commissions, educational aspects, development of documentation. Presently, an inventory of work sites is under way. During the process of certification, certain technical restructuring will take place, notably automation of certain processes now heavily dependent on manual labor. All of these measures are directed at an increase in technical-economical production level so as to fulfill the goals of the last year in the present five-year plan.

7813/9835  
CSO: 1841/259

UDC 658.52.011.56.012.3:658.524.017.3

FLEXIBLE AUTOMATION IN LOW-OUTPUT MASS PRODUCTION

Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 11, Nov 85 pp 4-6

[Article by F. Kh. Abdrakhmanov, deputy director, All-Union Scientific Research Institute of Pump Technology]

[Abstract] A particular problem affects automation of low-output mass production, such as involves machines used in the chemical industry, because of the need for frequent changes in the specifications of the product and product changeovers. It has been felt that manual operation in such situations constitute the optimal solution to the need for flexibility, but recent developments in robotics have modified this view. This has come about as a result of advances in robot technology and the availability of robots with capacity for decision-making, self-programming,

and for performing complex operations. Further improvements can be expected to come from standardization of the various elements in such automated systems and work stations, better management and application of available resources, and a better understanding of man-machine interactions. Figures 1.

12172/9835  
CSO: 1841/265

UDC 621.865.8.004.14:658.011.46

#### EFFECTIVE MACHINE USE AT ROBOT-EQUIPPED INSTALLATIONS

Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 11,  
Nov 85 pp 3-4

[Article by M. R. Glebov, engineer]

[Abstract] A cursory survey is presented of the effective use of robots at chemical machine construction plants, and the gain in productivity and cost effectiveness resulting from the implementation of such systems. The basic bottom-line is that the use of specifically-designed robots improves the coefficient of interchangeability of the machine tools 1.8- to 2.8-fold. However, counterproductivity can be encountered whenever inefficient robots are utilized, or efficient robots are underutilized. With increasing use of modular machine assemblies, the flexibility of manufacturing systems can be markedly increased and, in conjunction with robotics, the lag time for implementation of new technology can be decreased 2- to 3-fold.

12172/9835  
CSO: 1841/265

UDC 66.045:681.3.06.008.03

#### PROGRAMMED PROVISION OF AUTOMATIC SELECTION OF OPTIMUM STANDARDIZED COMPLEMENT OF HEAT EXCHANGE EQUIPMENT

Moscow TEORETICHESKIYE OSNOVY KHIMICHESKOY TEKHNologii in Russian Vol 19,  
No 6, Nov 85 (manuscript received 22 Apr 85) pp 814-818

[Article by V. V. Kafarov, V. P. Meshalkin and N. A. Perlov, Ufa Branch, All-Union Scientific Research and Design and Construction Institute for Petroleum Equipment; Moscow Chemicotechnological Institute imeni D. I. Mendeleev]

[Abstract] A key goal of scientific and technical advances in the chemical industry involves standardization of equipment within and between branches.

The minimum number of design variations that permit high quality and planned production amounts for heat exchange equipment (HEE) is the topic reported by the present article. Currently a typical HEE complement at a chemical plant will include 1000-3000 heat exchangers with 250-300 different design components. Such complexity causes severe stoppages for maintenance and repair that could be avoided with standardized apparatuses. The authors propose a procedure to simplify this equipment complement without loss of flexibility or production effectiveness. The process begins with engineering and technical calculation of technologic, hydraulic and design parameters for a given installation. Then these parameters are compared to specifications of available equipment, economic and production effectiveness factors are calculated, and the best available equipment for the production assignment is selected. Computer programs for processing these data have been designed using FORTRAN-IV, "PL/1" and "Assembler" computer languages, and recommendations have been made for replacing obsolescent and worn-out systems following these new guidelines. Altogether 638 devices and combinations and 358 other components have been considered, and the number of varying systems has been reduced from 186 to 33. References 3 (Russian).

12131/9835

CSO: 1841/260

UDC 62.622:621.43

USE OF HYDROGEN IN DUAL-FUEL CARBURETOR ENGINES

Moscow KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL in Russian No 11, Nov 85  
pp 22-24

[Article by A. I. Mishchenko, Institute of Problems of Machine Building,  
USSR Academy of Sciences]

[Abstract] The use of hydrogen as a fuel additive can broaden the limits of ignition of hydrocarbon fuels, increasing the effective leanness of the fuel-air mixture and intensifying combustion in internal combustion engines. The lower inflammability limit of a fuel increases and the stoichiometric coefficient decreases as the amount of hydrogen in a fuel increases. This widening limit is associated with the increase in active centers, with atomic hydrogen having the most rapid diffusion. As a result, the C:H ratio in the fuel has a determining effect on the reaction speed. Lowering this ratio can greatly increase the concentration of active centers and hence reaction speed. This can make the use of much leaner mixtures feasible. Measurements with motor ZMZ-24 showed the effective coefficient of usable work increased significantly with the addition of hydrogen, especially in regions of partial load on the engine. This was attributed to both intensified combustion and improved thermodynamic conditions. With gasoline motors, the hydrogen practically eliminated the emission of hydrocarbons and carbon monoxide, and also of nitrogen oxides, except under high engine loads. Application of these effects requires development of a universal dual-fuel supply system; this could be by addition of a supplementary chamber to a standard carburetor. A microprocessor scheme would be required to provide proper throttling depending on engine load and speed, but it could provide efficiency levels for gasoline engines on a par with modern diesel engines. Tests on experimental cars showed that even small additions of hydrogen reduced gasoline consumption by up to 40% and kept toxic emissions well below norms. Despite the problems of storing hydrogen on a vehicle and resupplying it, the significant advantages give this approach real promise. Figures 4; references 4 (Russian).

12672/9835

CSO: 1841/270



OPTIMAL PARTICLE SIZE UNDER LIMITING CONDITIONS OF AUTOIGNITION OF AIR  
SUSPENSIONS

Moscow KHIMIKO-FARMATSEVTICHESKIY ZHURNAL in Russian Vol 19, No 8, Aug 85  
(manuscript received 1 Mar 84) pp 1001-1003

[Article by V. I. Agudov and V. Ya. Yashin, All-Union Scientific Research  
Chemical-Pharmaceutical Institute imeni S. Ordzhonikidze, Moscow Oblast]

[Abstract] Use of earlier theoretical studies to calculate the lower concentration limit of ignition (LCLI) of an air suspension of solid particles is difficult without the correct functional variation of LCLI as a function of particle diameter. Equations for the variation of particle diameter required to support ignition as a function of temperature conductivity of air and heat of combustion of the substance have limited application. An analysis of the theory of flame propagation in air suspensions leads the authors to conclude that a new parameter should be included in the equation, responsible for radiant heat flux, which varies as the 4th power of the effective emission temperature. There is at present no effective means for estimating the effective radiation temperature. An equations presented in this article does allow determination of the interval within the area of dimensions of particles of a polydispersed material. The lower the melting point of a substance, the greater the dimensions of the particles at the LCLI.  
References 8 (Russian).

6508/9835  
CSO: 1841/229

UDC 541.135.5

INSTALLATION FOR RAPID RECORDING AND PROCESSING OF FREQUENCY DEPENDENCE OF  
ELECTRODE IMPEDANCE

Moscow ELEKTROKHIMIYA in Russian Vol 21, No 12, Dec 85  
(manuscript received 31 Jan 84) pp 1661-1665

[Article by S. P. Novitskiy, A. I. Masily, V. A. Mezentsev, B. Ya. Pirogov,  
R. Yu. Bek, A. Zh. Medvedev, O. N. Sidelnikova and I. I. Burenkov,  
Institute of Solid State Chemistry and Processing of Mineral Raw Materials,  
Siberian Department, USSR Academy of Sciences, Novosibirsk]

[Abstract] The authors have developed an installation with an SM-I computer allowing recording of the frequency dependence of impedance at high speeds to support direct measurement instruments. This article discusses the specifics of the design of the installation and its technical capabilities. The main unit of the installation, which determines its accuracy and speed, is the Kh-206 measuring unit, based on a measurement circuit which determines the impedance of the object studied, containing an impedance transducer and voltmeter. The use of this device allows polarization of the electrode being studied according to a program, i.e., assignment of the required potentiostatic or galvanostatic measurement mode and measurement of current and polarization potential, and also allows measurement of impedance at 20 Hz - 200 kHz with modulus values of 1 to  $10^6$  ohms and loss angle tangent of 0.1 to 10 with error not over 2%. The use of the installation for rapid measurement of the frequency variation of impedance allows rapid measurement and protects the objects being measured. Figures 5; references 5 (Russian).

6508/9835

CSO: 1841/290

INFLUENCE OF 2,2,6,6-TETRAMETHYL-4-OXYPIPERIDINE-1-OXYL RADICAL ON THE ELECTRIC, VISCOUS-ELASTIC, DIELECTRIC, AND ELECTROOPTICAL PROPERTIES OF p-METHOXYBENZYLIDENE-p'-n-BUTYLANILINE LIQUID CRYSTAL

Yerevan ARMYANSKIY KHIMICHESKIY ZHURNAL in Russian Vol 38, No 9, Sep 85  
(manuscript received 15 Nov 83) pp 537-542

[Article by A. E. Dingchyan, A. L. Manukhan, A. Ts. Sarkisyan and R. O. Matevosyan, Armenian Affiliate, All-Union Scientific Research Institute of Chemical Reagents and Highly Pure Chemical Substances, Yerevan]

[Abstract] The purpose of this work was to improve the electrooptical characteristics of the MBBA liquid crystal by doping with the nitroxyl radical (R). Conductivity and dielectric permeability were measured in a 3-electrode cell with conductive glass. Capacitance was measured by the AC method. Coefficients of elasticity and rotational viscosity were determined by measuring the phase delay between B-effect rays. Electrooptical effects were studied in sandwich cells, specimen thickness 20-50  $\mu\text{m}$ . As the concentration of R increases, the elasticity coefficients  $K_{33}$  and  $K_{11}$  decrease monotonically, while  $\gamma G_1$  decreases nonmonotonically. This results from the formation of complexes between MBBA and R molecules. Measurement of the variation of threshold voltage of electrohydrodynamic instability and dynamic light scattering as a function of R concentration in MBBA showed that at 0.5% some increase in voltage is observed as a result of the decrease in conductivity. Addition of R to MBBA decreases the dynamic light scattering rise and fall time significantly. Figures 4; references 9 (Russian).

6508/9835

CSO: 1841/227

MINIATURE CALCIUM-SELECTIVE ELECTRODES WITH SOLID INTERNAL CONTACT

Moscow ELEKTROKHIMIYA in Russian Vol 21, No 12, Dec 85  
(manuscript received 4 Jan 84) pp 1612-1616

[Article by S. Ye. Didina, A. L. Grekovich and Ye. A. Materova, Leningrad State University imeni A. A. Zhdanov]

[Abstract] Results are presented from an experiment on creation of miniature film-type calcium-selective electrodes with solid contact using various electrode-active systems. Two batches of miniature ion-selective electrodes were manufactured: One series utilized a silver chloride electrode, other a silver tetraphenyl borate electrode, produced by anodizing silver

wire in a sodium tetraphenyl borate solution. The most successful means of maintaining solid contact in calcium-selective electrodes is the use of electrodes containing a Ag/AgCl electrode as the current lead and 60% AV-17 resin in chloride form in the membrane phase. In cases in which the electrode is not to be used over 10 days, good characteristics can be achieved with solid contact electrodes containing potassium ferro-ferricyanide and a Pt current lead. Tables 3; references 6: 5 Russian, 1 Western.

6508/9835

CSO: 1841/290

UDC 541.183:547

EFFECT OF CRYSTALLOGRAPHIC SURFACE NON-UNIFORMITIES ON STRUCTURE OF DOUBLE LAYER AND ADSORPTION PROPERTIES OF CADMIUM ELECTRODE

Moscow ELEKTROKHIMIYA in Russian Vol 21, No 10, Oct 85  
(manuscript received 25 Oct 83) pp 1298-1304

[Article by A. P. Korotkov, Ye. B. Bezlepina, B. B. Damaskin and Ye. F. Golov,  
Moscow State University imeni M. V. Lomonosov]

[Abstract] The structural features of the double layer and the adsorption of ions and organic molecules onto solid mercuroid metals (Zn, Pb, Sn, Bi) are basically related to the crystallographic nonuniformity of the surface. A study was made of the effect of crystallographic surface non-uniformity on the adsorption properties and structure of the double layer of a Cd-electrode in solutions of surface active electrolytes. Peak disintegration was observed in the adsorption-desorption curves of the tetrabutylammonium cation on a polished polycrystalline Cd-electrode. The disintegration was not observed in solutions containing tetrapropyl- and tetraethylammonium cations nor on a cadmium surface as restored by cutting in solution. Figures 6; references 18: 16 Russian, 2 Western.

12765/9835

CSO: 1841/200

PHOTOEMISSION CURRENTS IN AQUEOUS SOLUTIONS OF ETHYLENE GLYCOL SATURATED  
WITH NITROUS OXIDE

Moscow ELEKTROKHIMIYA in Russian Vol 21, No 10, Oct 85  
(manuscript received 4 Nov 83) pp 1319-1324

[Article by Z. A. Rotenberg and R. G. Kokilashvili, Institute of  
Electrochemistry imeni A. N. Frumkin, USSR Academy of Sciences, Moscow]

[Abstract] While the  $\text{OH}^\cdot$  radical reacts with ethylene glycol (EG) to give a 1,2-dihydroxyethyl radical which then forms a formylmethyl radical  $-\text{CH}_2\text{CHO}$  in aqueous solutions, it has been demonstrated that at potentials more negative than  $-0.3\text{V}$ , this radical becomes reduced on the surface of a mercury electrode and oxidized at potentials more positive than  $-0.1\text{V}$ . EG radicals are oxidized and reduced on the same electrode at more negative potentials. While EG dehydration rate constants in acid solutions have been determined, such data for alkaline solutions have not yet been determined. In the present work, dehydration rate constants of the 1,2-dihydroxyethyl radical at various pH values and its adsorption were determined by measuring photoemission currents in  $\text{N}_2\text{O}$  solutions containing EG. It was demonstrated that as this radical becomes decomposed in solution, a hydroxymethyl radical is formed along with the formylmethyl. The EG dehydration rate constant and the yields of radicals were determined. The reaction mechanism during electron emission in non-aqueous EG is discussed. Figures 6; references 13: 5 Russian, 8 Western.

12765/9835  
CSO: 1841/200

UDC 541.138.2:546

DEVELOPMENT OF METHOD FOR STUDYING CORROSION OF CARBONACEOUS MATERIALS WITH  
DISC ELECTRODE WITH RING

Moscow ELEKTROKHIMIYA in Russian Vol 21, No 10, Oct 85  
(manuscript received 4 Oct 84) pp 1406-1408

[Article by N. M. Zagudayeva, K. A. Radyushkina and M. R. Tarasevich,  
Institute of Electrochemistry imeni A. N. Frumkin, USSR Academy of  
Sciences, Moscow]

[Abstract] Under conditions of anode polarization of carbonaceous materials, side reactions emitting  $\text{O}_2$ ,  $\text{CO}$  and  $\text{CO}_2$  occur, which cause corrosion of the carbon. Gasometry and chemical analysis, currently used to determine the corrosion rates, do not permit determination of partial reactions during current flow. In the present work, a method was developed to determine the individual currents corresponding to corrosion and oxygen evolution employing

a disc electrode and a ring. Polarization curves, obtained for isotropic and anisotropic pyrolytic carbon in 0.1N H<sub>2</sub>SO<sub>4</sub> and KOH, show that the anode rate on the isotropic carbon in both solutions is higher than that of the anisotropic. At 1.8 - 2.1v in acid solution, both carbons displayed a current lag caused by oxygen-containing groups. Data show that this method may be used to measure partial currents corresponding to oxygen formation and corrosion of carbonaceous materials. Figures 4; references 7: 6 Russian, 1 Western.

12765/9835  
CSO: 1841/200

UDC 531.135.5

#### STUDY OF CARBONATE-SELECTIVE MEMBRANES OF FILM TYPE BASED ON NEUTRAL COMPLEXON OF HEXYL TRIFLUOROACETYL BENZOATE

Moscow ELEKTROKHIMIYA in Russian Vol 21, No 10, Oct 85  
(manuscript received 29 Nov 83) pp 1335-1339

[Article by A. L. Smirnova, A. L. Grekovich and Ye. A. Materova, Leningrad State University imeni A. A. Zhdanov]

[Abstract] A systematic study of the properties of a carbonate-selective electrode membrane composed of hexyl trifluoroacetylbenzoate indicates that both the selectivity and the carbonate functional limits of the electrode are functions of the ratio of ligand to lipophile cation quantities. Membranes containing less than 0.01m exchanger and a ligand concentration exceeding that of the exchanger have optimum characteristics. A possible variant in the functioning of anion-selective membranes based on neutral complexons is proposed. Figures 3; references 9: 4 Russian, 5 Western.

12765/9835  
CSO: 1841/200

UDC 541.138-183

#### POSSIBILITY OF EVALUATING EFFECT OF INHIBITION OF ELECTROCHEMICAL REACTIONS WITH ORGANIC SURFACE ACTIVE AGENTS

Moscow ELEKTROKHIMIYA in Russian Vol 21, No 10, Oct 85  
(manuscript received 29 Mar 85; after revision, 10 Sep 84) pp 1358-1360

[Article by B. N. Afanasyev and O. N. Yeronko, Leningrad Technologic Institute imeni Lensovet]

[Abstract] A mathematical expression is presented by means of which it is possible to determine the electrochemical inhibiting effects of organic

surfactants. Experimental and calculated data are presented on the electro-reduction of  $\text{Cr}^{3+}$ ,  $\text{Eu}(\text{III})$  and  $\text{Zn}^{2+}$  ions as inhibited by 13 different surfactants. Figures 3; references 9 (Russian).

12765/9835  
CSO: 1841/200

UDC 541.135.5

QUANTITATIVE STUDY OF STRUCTURE OF DOUBLE ELECTRIC LAYER ON Tl-Ga ALLOY--  
STRUCTURE OF DOUBLE ELECTRIC LAYER IN SOLUTION OF INACTIVE ELECTROLYTE IN  
WATER

Moscow ELEKTROKHIMIYA in Russian Vol 21, No 10, Oct 85  
(manuscript received 8 Aug 84) pp 1378-1381

[Article by I. A. Bagotskaya, Chan Ngok Khay and V. G. Boytsov, Institute  
of Electrochemistry imeni A. N. Frumkin, USSR Academy of Sciences, Moscow]

[Abstract] Quantitative study of the structure of the double electric layer on Tl-Ga alloy is useful in connection with problems of the relationship between the work function and adsorption of electrons, particularly their lyophilicity, but also the structure of a substance and its electrochemical properties. In the present work an alloy containing 0.02 atom % Tl was used as a dropping electrode at 32°C with AC bridge at 400 Hz. Differential capacity curves were obtained for aqueous solutions of  $\text{H}_2\text{SO}_4$  and  $\text{Na}_2\text{SO}_4$ . Due to its low surface tension, the shape of the hanging drop as it emerges from the capillary deviates from spherical, so that only small droplets can be used. The results show that for Group III metals, the work function decreases with increasing atomic weight,  $\text{Ga} > \text{In} > \text{Tl}$ , while the adsorption potential of water diminishes in the same sequence. A linear relationship exists between the adsorption potential of water and the electron work function. Figures 4; references 10: 9 Russian, 1 Western.

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CSO: 1841/200

EXPLOSIVES AND EXPLOSIONS

UDC 621.51-987:331.45

SELF-IGNITION OF OIL IN HIGH-PRESSURE AIR COMPRESSORS

Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 11,  
Nov 85 pp 30-32

[Article by Yu. L. Smertyak, candidate of technical sciences]

[Abstract] An apparatus (SKVD-2) was devised for testing of self-ignition of oils used in high-pressure air compressors, basically consisting of a mixing chamber in which purified compressed air was mixed with oil samples. Lag times for self-combustion were determined at different temperatures. Oils used in high-pressure compressors were found to self-ignite at temperatures ranging from 225 to 287°C with lag times of 12 to 360 min. Addition of VNIINP-354 anti-oxidant to a concentration of 1.9% was effective in ensuring complete or partial inhibition of self-ignition of the oils tested. The key factor in predisposing to ignition was the air temperature. The data also indicate that oils selected for use in high-pressure air compressors should also be tested for susceptibility to self-ignition, in addition to conventional assessment for scale formation. Figures 1; references 6 (Russian).

12172/9835

CSO: 1841/265



CAKING OF AMMONIUM NITRATE

Ivanovo IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: KHIMIYA I KHIMICHESKAYA  
TEKHNOLOGIYA in Russian Vol 28, No 10, Oct 85  
(manuscript received 3 Jan 84) pp 84-87

[Article B. N. Brezgin, I. P. Klyus, V. B. Drozdovskiy and  
L. Yu. Olshanskaya, Department of Physics, Khmel'nitskiy Technologic  
Institute of Everyday Services]

[Abstract] This paper analyzes the mechanism of caking of ammonium nitrate and recommends a method of reducing it. Caking has been attributed to high moisture content or to the phase change at 32°C from rhombic to monoclinic crystals with an associated volume increase of 3.3%. This facilitates break-up of the crystal lattice and greatly increases hygroscopicity. Ammonium polyphosphate, formed by neutralization of phosphoric acid by gaseous ammonia at 180-190°C, was investigated as an additive to eliminate the phase transformation, or at least shift it to a higher temperature. Ammonium nitrate formed by ammoniation of nitric acid and consequent concentration to 93% was modified by the addition of the polyphosphate (P<sub>2</sub>O<sub>5</sub> content 61%) to provide granulated samples with a moisture content of 0.25-0.3% and a P<sub>2</sub>O<sub>5</sub> content of 0.1, 0.5, 1.0, 2.0, and 5.0 wt %. These additions increased the phase transformation temperature up to 37°C and lowered the heat of transition from 22.5 to a low of 6.4 kJ/kg for the 1.0 and 2.0 wt % samples. These samples showed the lowest caking tendency and had the best grain strength. The shift of the phase transition temperature is apparently not as important as the change in the heat of transition, with a lower heat of transition decreasing the moisture content of the crystals. The increase in granule strength is also attributed to the formation of solid solutions of polyphosphate and nitrate. Figures 1; references 7 (Russian).

12672/9835  
CSO: 1841/255

## PROCESS OF PRODUCING VANADIUM-CONTAINING GRANULATED SUPERPHOSPHATE AND ITS USE IN AGRICULTURE

Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 11, Nov 85 pp 659-661

[Article by Ya. I. Rustamov, Z. R. Movsumov, M. V. Lykov, S. S. Orydzhev, Z. A. Nadirov and R. A. Sardarli]

[Abstract] A study was made of the kinetic and technological characteristics of granulation of powdered superphosphate with vanadium-containing additives in an industrial drum apparatus, and data are presented on the effectiveness of this fertilizer in agriculture. Spent catalyst from the production of sulfuric acid was used as the vanadium-containing component. The beginning of accumulation of granule fractions occurs slightly after the beginning of the process, indicating an induction period. Vanadium-containing granulated superphosphate has been widely used in agriculture. Testing of the new fertilizer under field conditions showed that it increases the yield of agricultural crops by 15-18% and accelerates fixation of atmospheric nitrogen. Figure 1; references 5 (Russian).

6508/9835

CSO: 1841/213

## ANALYSIS OF QUALITY OF KARATAU PHOSPHORITES ARRIVING FOR SULFURIC ACID PROCESSING

Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 11, Nov 85 pp 661-664

[Article by P. V. Klassen, Yu. A. Zaveleshinskiy, V. A. Zykov, A. A. Novikov and V. N. Shumeyko]

[Abstract] Since 1969, fertilizer has been manufactured using phosphorite flour from Karatau with the following compositions, weight percent:  $P_2O_5$ --28,  $MgO$ --2.0 and  $CO_2$ --6.0. Beginning in 1976, flour containing 26-27%  $P_2O_5$  began to be used, in 1977, run-of-mine or with 24.5%  $P_2O_5$ , in 1983--flotation concentrate with the same content of  $P_2O_5$ . The chemical, mineralogical and particle-size composition of this raw material are described. An analysis of the functioning of systems for production of the fertilizer indicates that a decrease in the content of  $P_2O_5$  in the phosphate raw material of Karatau and a relative increase in the content of harmful components leads to an increase in the consumption of sulfuric acid, a decrease in the capacity of a standard process line and in the reliability of operation of the equipment. The flour must be prepared both by averaging and by enrichment of non-standard ores in order to stabilize the operation of the fertilizer production facilities. Figures 6.

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PRODUCTION OF AMINO ACID MIXTURES FROM BAKER'S YEAST AUTOLYSATES. PART 4.  
FULL AUTOLYSATE PURIFICATION PLAN

Moscow KHIMIKO-FARMATSEVTICHESKIY ZHURNAL in Russian Vol 19, No 4, Aug 85  
(manuscript received 28 Feb 84) pp 998-1001

[Article by A. D. Neklidov, All-Union Scientific Research Institute of  
Antibiotics, Moscow]

[Abstract] A generalized plan of the production of amino acid mixtures is presented. Various combination of stages of adsorption, chromatography and hydrolytic processing were studied to select an optimal technological plan for purification and processing of yeast autolysates. It was found that the effectiveness of decoloration of an amino acid-peptide mixture can be significantly increased by adsorption on IA-1r resin as the last stage of chromatographic purification of the autolysate. Preliminary ultrafiltration through SM-22 membranes avoids the problem of decreasing the capacity of the resin by irreversible adsorption of humic substances. The combination of ion exchange and adsorption methods of purification of yeast autolysates can produce amino acid-peptide mixtures suitable for therapeutic use. References 9: 8 Russian, 1 Western.

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CSO: 1841/229

UDC 66.048.54:663.035

VACUUM EVAPORATION INSTALLATION FOR YEAST SUSPENSIONS

Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 11,  
Nov 85 pp 16-17

[Article by A. V. Gerasimenko and Ye. M. Kovelev, engineers, Ye. P. Novikov, L. P. Pertsev and Yu. N. Piskunov, candidates of technical sciences, and N. M. Bespyatova, engineer]

[Abstract] A schematic is provided of a vacuum evaporator for yeast suspensions, with outline details of operation. The equipment described

has a 3-fold greater productivity than standard equipment commonly in use. A 6.7% (dry weight) yeast suspension can be evaporated to a 19-20% (dry wt.) product by a series of steps involving initial heating to 105°C for 45 min, degasification and boil-off at 56-87°C as a result of pressure change. The apparatus contains feedback control modules and, under pilot conditions, has been shown to have a productivity of 60 tons/h of evaporated water. The machine was designed at the Ukrainian Scientific Research Institute of Chemical Machines, and will be manufactured by the "Uralkhimmash" Industrial Association. Figure 1.

12172/9835

CSO: 1841/265

#### OUTLOOK FOR USE OF RADIATION TECHNOLOGY IN FEED PRODUCTION

Moscow KHIMIYA VYSOKIKH ENERGIY in Russian Vol 19, No 6, Nov-Dec 85  
(manuscript received 24 Apr 85) pp 483-489

[Article by B. G. Yershov and Ye. P. Petryayev, Institute of Physical Chemistry, USSR Academy of Sciences; Belorussian State University imeni V. I. Lenin]

[Abstract] The largest potential is shown by the production of feed or additives from non-feed plant material such as the high-cellulose biomass residue of lumber, cotton, corn, grain, and sunflower processing. Ionizing radiation breaks down the crystalline structure of the cellulose; e.g., a dose of 1.8 MGR of  $\gamma$ -radiation from  $^{60}\text{Co}$  lowers the cellulose content of aspen wood from 45% to 11%. Straw is even more susceptible to such radiation-induced decomposition, greatly increasing the content of easily hydrolyzed polysaccharides. Such material has been used as a 5-10% replacement of regular feed for broiler chickens as feed for dairy cattle. Even doses under 100 kGR significantly improved the digestibility of straw; feed granules with 70% straw modified by fast electrons improved cattle growth without any negative hematologic effects. Excess active sludge and sewage residues can also be radiation-treated to provide feed biomass with good protein content. Doses of 2-3 kGR kill 99.9% of pathogenic bacteria; doses of 20-40 kGR provide total sterilization and also improve the filtration characteristics. One experiment yielded feed with 29.9% protein, 23.7% albumin, and 4.8% fat. Comparable radiation doses can also be used to sterilize standard feed and silage. Doses up to 10 kGR also improve the protein yield of yeast and microbiological cultures using plant raw material. If radiation-processed feed additives were used at a 5-10% rate in 1985-1990, this could supply 25-50 million tons and further raise the nourishment value of current feed. Electron accelerators could satisfy the requirements for a large poultry complex with a cost of 30-40 rubles per ton to process plant raw material into feed, or for a 10,000 head cattle ranch with a processing cost of about 5 rubles per ton. More powerful and effective  $\gamma$ -radiation could be obtained from nuclear reactors with a cost on the order of 60 rubles per ton to process feed additives from plant raw material.

High-temperatures, gas-cooled reactors could also provide radiation for both sterilization and chemical conversions. Sterilization could also use  $^{137}\text{Cs}$ . Overall, radiation technology holds promise for a wide range of potential applications in the feed industry. References 27: 20 Russian, 7 Western.

12672/9835

CSO: 1841/254

UDC: 661.862.65-033.2

BASIC PRINCIPLES OF PRODUCTION OF HEAT-RESISTANT BINDER SYSTEMS AND MATERIALS  
BASED ON THEM BY MECHANICAL ACTIVATION

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA  
KHIMICHESKIYE NAUKI in Russian Vol 15, No 5, Sep-Oct 85  
(manuscript received 6 Aug 84) pp 119-124

[Article by P. L. Mityakin, Department of Physical-Technical Problems of  
Metallurgy, Novosibirsk]

[Abstract] Initial results are presented from studies on development of heat-resistant binder systems and materials based upon them by mechanical activation. The heat-resistant binders produced aqueous ceramic binder suspensions (ACBS) in a ball mill lined with a high alumina ceramic using corundum milling bodies, grinding time 12-24 hours. Binders studied include quartz sand, dinas, chamotte, and fused mullite with dinas and chamotte fillers. After grinding, the ACBS were mixed in a periodic mill to stabilize them, then slip-cast in active gypsum molds, removed after 4 to 12 hours and dried at 40-110°C for 16-24 hours. The studies showed that one possible reason for the binder properties of quartz sand and aluminosilicates is the production, during mechanical activation and subsequent stabilization, of certain quantities of inorganic silicic or aluminosilicic acids. The ACBS based on quartz sand and fused quartz were successfully tested as mold liners and molds, while the ceramic concrete specimens were used as heat-resistant liners of various heating devices. Figures 4; references 37: 29 Russian, 8 Western.

6508/9835

CSO: 1841/235

## PREPARATION OF COMPOSITE MATERIALS BASED ON POLYVINYLCHLORIDE AND GRANULATED BUTADIENE-STYRENE RUBBER

Ivanovo IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: KHIMIYA I KHIMICHESKAYA TEKHNOLOGIYA in Russian Vol 28, No 10, Oct 85  
(manuscript received 9 Jul 84) pp 99-102

[Article by O. Yu. Solovyeva, N. D. Zakharov and O. A. Zakharkin,  
Department of the Chemistry and Technology of Processing Elastomers,  
Yaroslavl Polytechnic Institute]

[Abstract] Polyvinyl chloride Ye-66 and powdered butadiene-styrene elastomer SKMS-30ARK (average particle size 3.14 mm) were combined in a mixer equipped with a special cutting-dispersing device. A third component was a 20% aqueous solution of resorcinol formaldehyde resin SF-282. The initial mix was composed (parts by weight) of the Ye-66 (50), resin (3.5, dry basis), stearin (1.5), zinc oxide (2.5), santokyr (0.5), thiouram (0.7), and sulfur (1.0). Mixing showed two periods. First, a reduction of the elastomer particles with simultaneous infusion of the polyvinyl chloride, accompanied with a reduction in effective power and in the average particle size and an increase in temperature. Then, an agglomeration of the particles after most of the polyvinyl chloride had been added and the elastomer had been fully reduced; effective power, average particle size, and temperature all rose. To determine the best surface contact and component mixing, three regimes were tested: I - the resin solution was added at the mixing cycle; II - the resin solution was added at the point of maximum particle dispersion; and III - the resin solution was added into the polyvinyl chloride at the beginning of the cycle and the elastomer added at the point of minimal particle size. Because of lowered efficiency of the size reduction due to decreased viscosity, regimes I and II showed initial drops in effective power; it then rose as particles agglomerated, water evaporated, and cutting became more efficient. Then it fell again as average particle size dropped with continued size reduction. Regime III first showed a slight and then a pronounced rise in the effective power, which then gradually fell as particle size was reduced. In all cases, the process temperature rose smoothly and then stabilized, although it did show a temporary drop in regime III when the cooler elastomer was added to the mix. Comparisons of the composite materials with composites prepared by traditional vulcanization and roller technology showed all of the powder technology composites had better physico-mechanical properties. The best results were from regime II which allowed condensation of the resin to begin and proceed in the presence of both polymer components, and also apparently provided the best surface contact with uncondensed resin. Figures 2; references 3 (Russian).

12672/9835  
CSO: 1841/255

CRYSTALLIZATION MECHANISM OF CALCIUM SULFATE SEMIHYDRATE UNDER CONDITIONS  
MODELING PRODUCTION OF PHOSPHORIC ACID BY SEMIHYDRATE PROCESS

Moscow TEORETICHESKIYE OSNOVY KHIMICHESKOY TEKHNologii in Russian Vol 19,  
No 6, Nov-Dec 85 (manuscript received 30 Jul 84) pp 742-748

[Article by I. V. Melikhov, I. Ye. Mikheyeva, and V. N. Rudin, Moscow  
State University imeni M. V. Lomonosov; Scientific Research Institute  
for Fertilizers and Insectofungicides imeni Professor Ya. V. Samoylov]

[Abstract] Crystallization of  $\text{CaSO}_4 \cdot 0.5\text{H}_2\text{O}$  is a fundamental stage in  
producing extraction phosphoric acid by a semihydrate process. The present  
article reports on study of the morphology of crystals thus obtained, by  
electron microscope without phase separation. A much more rapid isolation  
of the high-dispersion phase was noted; the phase then formed aggregates  
that became pseudomonocrystals. The procedures for crystallization are  
diagrammed and summarized. Crystallization was found to begin with the  
formation of numerous ultramicrocrystals of  $\text{CaSO}_4 \cdot 0.5\text{H}_2\text{O}$  in the form of  
hexagonal prisms. Formulas are developed for changes in crystal dimensions  
and fluctuations in their rate of formation. Results showed that the  
addition of the semihydrate for seeding was effective in accelerating  
nucleation if the weight of seeding crystals grew faster than the weight  
of the ultramicrocrystals. Purification (elimination of phosphoric acid)  
and crystal growth as well were only effective if the proper balance with  
seeding crystals was maintained. Figures 5; references 10: 5 Russian,  
5 Western.

12131/9835

CSO: 1841/260



UDC: 615.356:577.164.2].012.07

KINETICS OF HETEROGENEOUS PROCESS OF ACETONATION OF L-SORBOSE ON IONITES

Moscow KHIMIKO-FARMATSEVTICHESKIY ZHURNAL in Russian Vol 19, No 8, Aug 85  
(manuscript received 16 Aug 83) pp 991-995

[Article by I. D. Chapanov, V. A. Nikiforov and V. V. Zarutskiy, All-Union Scientific and Production Institute, "Promavtomatika," Groznyy]

[Abstract] The purpose of this work was mathematical modeling and optimal planning of the process of heterogeneous acetonation on ion-exchange resins. Systems of equations are presented which reflect the physical-chemical phenomena which form the basis of the process of acetonation and adequately describe the quantitative and qualitative regularities within the limits of variation of the basic parameters defining the process. Data obtained on acetonation of L-sorbose in media with varying moisture content allowed a new interpretation of the mechanism of the process and its limiting stages. The experimental results cannot be explained by the previously suggested quasi-homogeneous approach to the kinetics of catalytic reactions on ionites. Changes in the order of the catalytic reaction indicate that it involves the formation of intermediate active complexes, their formation being the limiting stage. It is confirmed that two forms of water are present in the pores of the ionite, influencing catalysis differently. Figure 1; references 9: 8 Russian, 1 Western.

6508/9835

CSO: 1841/229

## NITROGEN COMPOUNDS

UDC: 546.562

### SYNTHESIS AND PHYSICAL-CHEMICAL PROPERTIES OF COPPER HYPOPHOSPHITE UREA COMPLEX

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIYE NAUKI in Russian Vol 15, No 5, Sep-Oct 85 pp 65-67

[Article by A. Yu. Yagodin, Institute of Solid State Chemistry and Processing of Mineral Raw Materials, Siberian Department, USSR Academy of Sciences, Novosibirsk]

[Abstract] Continuing their work on copper complexes of hypophosphonous acid, the authors synthesized a urea complex of copper hypophosphite from aqueous solutions containing a salt of bivalent copper, hypophosphonous acid salt and urea. In the presence of an excess of urea, the complex formation process suppresses the oxidation-reduction reaction which may occur in the solution between ions of copper and hypophosphite ions. IR absorption spectra of the crystalline complex were recorded in vaseline oil and KBr tablets, yielding absorption bands at the oscillating frequencies of the hypophosphite ion and urea. The complex is a thermally unstable compound. Signs of decomposition appear at room temperature after approximately one day. Decomposition of the solid complex becomes rapid at about 50°C and occurs topochemically, i. e., through the formation and growth of nuclei of the reaction product. References 9: 8 Russian, 1 Western.

6508/9835

CSO: 1841/235

UDC 541.49+541.9

### POLYAZAMACROCYCLIC LIGANDS AND THEIR METALLOCOMPLEXES

Moscow ZHURNAL VSESOYUZNOGO KHIMICHESKOGO OBSHCHESTVA IM. D. I. MENDELEYEVA in Russian Vol 30, No 5, Sep-Oct 85 pp 519-527

[Article by K. B. Yatsimirskiy, academician, Ukrainian SSR Academy of Sciences]

[Abstract] A review is presented of the polyazamacrocyclic ligands, including recent research trends, nomenclature, and physicochemical characteristics.

These compounds contain at least three donor nitrogen atoms within a ring formed by no less than nine atoms. The polyazamacrocyclics function as virtually universal ligands, with the complexes exhibiting a variety of interesting characteristics, among which are controllable redox properties, stabilization of unusual degrees of metal oxidation states, catalytic properties, and suitability for application in electronics and dyes. To date, more than 30 metals have been identified as forming complexes with the polyazamacrocyclics, with the basic synthetic approaches outlined. The catalytic scope of such complexes has been shown to include oxidation of ascorbic acid by oxygen, decomposition of hydrogen peroxide, photooxidation of methanol to formaldehyde, oxidation of various other aliphatic alcohols, and reduction of water to hydrogen. These macrocyclic complexes have also found use in the construction of photochemical cells for utilization of solar energy, as well as in metal extraction. The full potential of practical applications has not yet been explored because these compounds have largely remained within the research interests of specialists in coordination and organic chemistry. References 69: 22 Russian, 47 Western.

12172/9835

CSO: 1841/238

UDC: 661.56.001.57

#### OPTIMAL ORGANIZATION OF POWER TECHNOLOGY PROCESSES IN PRODUCTION OF DILUTE NITRIC ACID

Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 11, Nov 85 pp 689-692

[Article by V. V. Kafarov, I. M. Kisil, V. L. Perov, D. A. Vovrov, A. Yu. Naletov, S. S. Ovdina and E. A. Novikov]

[Abstract] The production of nitric acid is one of the most energy consuming processes in the chemical industry. Problems of optimal organization of power and technological processes, which form a single power-technological system for the production of dilute nitric acid, are therefore particularly significant. Equations are presented which can be used to calculate conditions for reducing the power consumption of the process. A flow chart is presented of an algorithm for 2-level optimization of the power subsystem in the production of dilute nitric acid. The optimal structure of technological interconnections of elements in the power subsystem is illustrated. The possibility is demonstrated of intensifying the production of dilute nitric acid by redistributing power loads in the process and a method is suggested for organizing the power element of the combined system to achieve a significant savings in power. Figures 6; references 9 (Russian).

6508/9835

CSO: 1841/213

## COMPUTING STRUCTURE AND EVALUATING REACTIVITY OF N-METHYL-N'-(beta-D-XYLOPYRANOSYL)-N-NITROSOUREA UNDER CONDITIONS OF ACID-BASE CATALYSIS

Kiev TEORETICHESKAYA I EKSPERIMENTALNAYA KHIMIYA in Russian Vol 21,  
No 5, Sep-Oct 85 (manuscript received 6 May 83; after revision 5 Jul 85)  
pp 596-599

[Article by M. A. Ashirmatov, Zh. A. Dzhamanbayev, B. K. Sadybakasov and  
V. A. Afanasyev, Institute of Organic Chemistry, KiSSR Academy of Sciences,  
Frunze]

[Abstract] Derivatives of N-nitroso-N-alkylurea are potentially useful in cancer chemotherapy and as chemical mutagens in agriculture. Introduction of monosaccharide groups to the nitrosoalkylurea structure lowers the toxicity and alters the selectivity of action. Problems such as the relation of biological activity to structure and the mechanism of action may be approached by studying the electron structure of derivatives and its changes during acid-base catalysis. In the present work a study of the structure of N-methyl-N'-(beta-D-pyranoxilosyl-urea) (I) and its nitroso derivative (II) by MO LCAO shows that the wide variation in energy of molecule (I) between the free state and the crystalline is due to the potential energy of the crystal field and the intermolecular hydrogen bonds. Analysis of charge distribution on the atoms indicates that the carbonyl group is the most probable site for protonation and nucleophilic attack in (I) and (II). An outline of the changes in electron structure and properties of reaction sites under model conditions of acid-base catalysis was obtained. Figures 4; references 6: 4 Russian, 2 Western.

12765/9835

CSO: 1841/224

UDC 541.49:546.32/546.57/542.6

INTERFACE TRANSPORT OF POTASSIUM AND SILVER PICRATES ENHANCED BY MACROCYCLIC POLYESTERS

Kiev TEORETICHESKAYA I EKSPERIMENTALNAYA KHIMIYA in Russian Vol 21, No 5, Sep-Oct 85 (manuscript received 25 Oct 84) pp 600-604

[Article by K. B. Yatsimirskiy, G. G. Talanova and A. A. Chaykovskaya, Institute of Physical Chemistry imeni L. V. Pisarzhevskiy, UkSSR Academy of Sciences, Kiev]

[Abstract] The nature of the donor atoms of the macrocycle has a profound effect on the membrane-transport properties of macrocyclic polyesters in respect to Group I metal ions. A study was made of the transport of potassium and silver picrates through a liquid dichloroethane membrane in the presence of macrocyclic polyesters containing thiophosphonyl groups and dithia-18-crown-6, diaza-18-crown-6 and dibenzo-18-crown-6 as ionophors containing oxygen, nitrogen, sulfur, and thiophosphonyl groups in the cycle. A correlation was established between the rate of interface transport and the salt extraction constant from the aqueous phase to the organic as enhanced by macrocyclic polyesters. Figures 2; references 10: 4 Russian, 6 Western.

12765/9835  
CSO: 1841/224

UDC 547.26'118

MACROHETEROCYCLIC PHOSPHORUS COMPOUNDS

Moscow ZHURNAL VSESOYUZNOGO KHIMICHESKOGO OBSHCHESTVA IM. D. I. MENDELEYEVA  
in Russian Vol 30, No 5, Sep-Oct 85 pp 528-535

[Article by L. N. Markovskiy, corresponding member, Ukrainian SSR Academy of Sciences, doctor of chemical sciences, and V. I. Kalchenko, candidate of chemical sciences]

[Abstract] A minireview is presented of the current state of macroheterocyclic phosphorus compounds, divided into two broad categories: macrocycles with endo-cyclic tri- and pentavalent phosphorus, and macrocycles with exocyclic groups of tri- and pentavalent phosphorus. Such organophosphorus complexing agents have been investigated to a far lesser extent than their nitrogen and sulfur analogs. In both categories of macroheterocyclics the phosphorus atoms can be either in the tri-coordinated state with an unshared electron pair, or in a tetra-coordinated state in which adjacent oxygen, sulfur or nitrogen atoms serve as donors. In addition, compounds are also known in which a phosphonium or a phosphorane group functions as a binding element in the macrocycle devoid of donor functions. A total of 41 structural formulas are presented with pertinent facts discussed, covering most of the known compounds in this class. Figures 57: 17 Russian, 40 Western.

12172/9835

CSO: 1841/238

## PESTICIDES

UDC 632.954

### PERSISTENCE OF HERBICIDES

Moscow ZASHCHITA RASTENIY in Russian No 11, Nov 85 pp 16-18

[Article by I. A. Kavolyunayte and B. V. Melamed, senior science associates, Vokesk Affiliate, Lithuanian Scientific Research Institute of Agriculture]

[Abstract] The persistence of herbicides in plants and in the cultivated layer of the soil is an important factor which must be considered in determining which herbicides to use. This article lists several herbicides and notes the results of tests and experience of their use. Herbicides discussed include sodium trichloroacetate, 2,4-D, bazagran, triazime herbicides including simazine, atrazine and propazine, promethrin and pagnazone. The possibility of accumulation of persistent herbicides upon repeated application has been studied in ten year experiments in the laboratory. The data obtained indicate that herbicides are not accumulated in the soil, primarily decomposing in the soil. The fraction of the preparations which was physically washed from soil samples was small. In field experiments, the herbicide content of the soil varied with rainfall, particularly for sodium trichloroacetate. Herbicides were found to decompose in all crops, the rate of disappearance varying. Residues to all herbicides were at safe levels when the herbicides were used according to directions. They disappeared from the soil in a single vegetation period, except for the chlorotriazine herbicides.

6508/9835

CSO: 1841/257

## HYGIENIC REGULATION OF HERBICIDES

Moscow ZASHCHITA RASTENIY in Russian No 11, Nov 85 p 29

[Article by L. I. Bidnenko, senior science associate, All-Union Scientific Research Institute of Hygiene and Toxicology]

[Abstract] The use of herbicides on corn is discussed. Safe utilization demands consideration of such factors as persistence, migration, accumulation and transformation. While most herbicides fully decompose during one season, preventing their influence on subsequent plantings, simazine and atrazine may remain for 1.5-2 years. Clayey and humus-rich soils firmly bond these herbicides and prevent them from passing through roots into plants. The plants themselves participate in detoxication of the herbicides. Corn contains a substance which renders simazine harmless to plants. Plant detoxication of herbicides usually produces metabolites which are much less toxic. However, in certain soil types and climate areas the detoxication process is altered, possibly forming toxic intermediate or end products. This means that identification of metabolites and studies of their toxic properties are quite important for ecology.

6508/9835

CSO: 1841/257



## PETROLEUM PROCESSING TECHNOLOGY

### OIL PRODUCTION SHORTFALL

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 17 Jan 86 p 3

[Article "Oil: To Increase Production Rate" by SOTSIALISTICHESKAYA INDUSTRIYA's Heavy Industry Department]

[Text] The last month of this past year brought no substantial change in oil producers' performance. Their shortfall has not diminished--on the contrary, it has grown by 3 million tons. Here are the December results for Minnefteprom's [Ministry for the Petroleum Industry] leading production associations. (Enterprises and the percentage of plan fulfillment are given.)

GLAVTYUMENNEFTEGAZ as a whole	90.8
"Nizhnevartovskneftegaz"	92.5
"Yuganskneftegaz"	100.6
"Surgutneftegaz"	102.4
"Noyabrskneftegaz"	65
"Krasnoleninskneftegaz"	78.8
"Vareganneftegaz"	71.3
"TATNEFT"	99.4
"BASHNEFT"	99
"TOMSKNEFT"	96.1
"KOMINEFT"	92.6
"KUYBYSHEVNEFT"	100.3
"PERMNEFT"	100.9
"ORENBURGNEFT"	101.3

"UDMURTNEFT"	100.5
"GROZNEFT"	102.5
"UKRNEFT"	101.2
"MANGYSHLAKNEFT"	100.4
"TURKMENNEFT"	104.2

Not one of the associations which are behind (they account for one-third of the total number) managed to correct things in December. Fields in western Siberia's Nizhnevartovsk, Noyabrsk, Vargansk, and Krasnoleninsk oil regions, the Komi ASSR, and Azerbaijan owe a large amount of liquid fuel.

The results of the final year of the Five-Year Plan are, on the whole, not reassuring. Minnefteprom subdivisions undersupplied the national economy by more than 31 million tons of crude hydrocarbon. More than 90 percent of this deficit is attributable to northern Tyumen oil fields. Their shortfall is basically holding back the entire industry.

Reasons for the oil fields' unsatisfactory performance were thoroughly analyzed at a meeting of Tyumen and Tomsk Oblast Party management, held in September 1985. Ministry and Glavtyumenftegaz managers were unable to prepare properly for the new, more complex stage in development of the country's main fuel base. Time was lost switching from primarily gusher techniques of oil extraction to modern, mechanized technology, and new fields were assimilated slowly. There were miscalculations in solving imminent social problems, as well as serious deficiencies in management style and procedures.

After the meeting, steps were taken to restructure the business organization at all levels: from Ministry staff to field teams, oilmen received a great deal of help. As a result, average annual output rose in the second semester. However, there is still a long way to go before all reserves are put into action.

The most important of these is more complete and effective use of productive potential and extractive capacities. Here is just one fact: Today in the northern fields, about 3,000 wells beyond the norm are inactive. If they were put into production, there would be a sizeable increase in output.

Construction and startup of new wells is proceeding slowly.

The leading collectives of the Tyumen Glavka are an example of large potential capacities. Under the same complex conditions, they are achieving outstanding results. The "Yuganskftegaz" Association, where they pay a great deal of attention to working laboriously with the stock of wells, is steadily increasing fuel output. In the past year, it has produced more than 100,000 tons of oil above the plan, and this year has also started off well. But the experience of this, as well as other right-flank oil producer and driller collectives, is being poorly disseminated.

Even old oil fields have significant reserves. In several regions, output of exhausted beds can be significantly increased, and oil well life can be extended by using thermal and chemical methods. However, their introduction has basically not gone beyond the test stage. And, although the industry has overfulfilled its annual assignment for oil production by new methods, the scale of work in this important area is small. This situation is no longer tolerable.

There is no doubt that responsibility for the lag in oil recovery lies primarily with industry managers. But today oilmen need even more active support from related industries: construction, power engineering, oilfield and drilling equipment suppliers.

Is it really accepted as normal that establishment of many northern fields has been delayed for several years? Even at the famous Samotlor, which has already passed its peak, not all of the facilities called for in the plan have been built yet. Extremely unreliable electrical supply makes it impossible to achieve stable operation. Frequent power failures lead to large-scale well shutdowns.

Oil producers' complaints against enterprises of the Ministry for Chemical and Petroleum Machine-Building are just. Neither the quantity, technical level, nor quality of manufacture of the machinery and equipment they supply is adequate for the complex tasks confronting the industry. Oil fields do not have enough pipe, high-capacity electric centrifugal pumps, and well repair and assimilation assemblies. Nor is Minnefteprom receiving enough drilling rigs, which are required to assimilate new fields in Tyumen Oblast.

The CPSU Central Committee and the USSR Council of Ministers recently passed a decree on development of western Siberia's oil and gas complex. It called for large-scale measures to accelerate scientific and technical progress in the region. Minnefteprom specialists, together with those in related industries, have developed specific programs intended to fundamentally increase the level of machine-building and other oilfield products. However, one cannot ignore the fact that realization of this plan will take a certain amount of time, while the oil production rate has to be raised today. Business partners must immediately respond to oil producers' demands and supply everything they require in full.

The other day, Minnefteprom's Central Dispatcher Administration received data on the industry's performance for the first 10 days of January. Unfortunately, the numbers give no cause for rejoicing: in the first 10 days, it is already 450,000 tons of oil behind the plan. As before, Glavtyumenneftegaz has the greatest deficit.

However, there are hopeful signs in this interim summary. Oilmen of the Siberian "branch" of the "Vashneft" Association and of the Komi Republic, who were behind in December, have exceeded their planned daily output. - Now it is important to reinforce and develop these, as yet, minor successes.

12809/9835

CSO: 8144/0725

UDC 665.5(47.922)

INCREASE OF OCTANE NUMBER OF PLATFORMING GASOLINE FROM BATUMI OIL REFINERY

Tbilisi SOOBShCHENIYA AKADEMII NAUK GRUZINSKOY SSR in Russian Vol 118,  
No 3, Jun 85 (manuscript received 12 Feb 83) pp 529-531

[Article by M. K. Gadzhiev, N. M. Nebiyev and Kh. I. Areshidze,  
academician, GSSR Academy of Sciences, Institute of Physical and Organic  
Chemistry imeni P. G. Melikishvili, GSSR Academy of Sciences]

[Abstract] Using zeolite CaA to extract normal alkanes from platforming gasoline of the Batumi oil refinery improved product quality and provided raw material for further refining or for production of various organic chemicals. These experiments were carried out on a batch process in three stages--adsorption, desorption, and regeneration of the adsorbent--at temperatures of 80-200°C with pressures of 80 mm Hg and at temperatures of 120-260°C for 760 mm Hg. After removal of the nonadsorbed portion of the raw material, desorption was carried out at 300°C and a residual pressure of 5 mm Hg in a nitrogen stream. On the basis of these experiments, graphs showing the temperature and pressure dependence of the alkane yield were constructed. These indicated that temperature had a much larger effect than pressure; the best extraction of normal alkanes was at 100°C and 80 mm Hg pressure. This increased the octane number from 76 to 82; addition of a standard quantity (0.73 mg/kg) of tetraethyl lead further increased it to 96. Chromatographic analysis of the adsorbed portion of normal alkanes showed the major constituents to be octane, heptane, hexane, and pentane, with 26.0, 24.0, 19.0, and 13.6 wt. % respectively. Figures 2; references 7 (Russian).

12672/9835

CSO: 1841/267

## HYGIENIC RESEARCH ON GASOLINE-METHANOL MIXTURE

Moscow KHIMIYA I TEKHOLOGIYA TOPLIV I MASEL in Russian No 11, Nov 85  
pp 43-44

[Article by A. A. Kasparov, Yu. G. Shirokov and N. P. Golovkova,  
Scientific Research Institute of Labor Hygiene and Occupational Diseases,  
USSR Academy of Medical Sciences]

[Abstract] Toxicological study of the action of a mix of 76.4% gasoline A-72, 14.8% methanol, and 8.8% isobutanol indicated that the threshold concentrations have an additive character for the action of individual components. This would put the mixture into Class III of life threatening substances. Specific research showed no ophthalmological, histological, gonadic or embryotropic activity. It did show skin resorptive activity, but only local irritation on short-time exposure to healthy skin in open air. Determinations of concentrations in air were made by use of a solid adsorbent with subsequent solvent extraction and determination by gas chromatography; sensitivity was 0.01  $\mu\text{g}$  for the alcohols and 0.005  $\mu\text{g}$  for the hydrocarbons. Evaluation was carried out in urban use of a ZIL-130, [auto] using gasoline-methanol mixtures BMS and BM 15-93 (based on gasoline with octane number 66). Vehicles included new, average and worn motors and were tested on highway driving, city driving, and idling. Concentrations of the mixture components and of formaldehyde in the passenger compartment was below maximum acceptable concentrations in all cases in summer and transition seasons. Winter concentrations in some cases doubled the methanol limit and approached the isobutanol limit. Highest readings were with BM 15-93 in vehicles idling in winter conditions, with methanol concentrations exceeding the acceptable limit in 62% of the samples and reaching a maximum of 24.3  $\mu\text{g}/\text{m}^3$ . Measurements of atmospheric contamination by exhaust fumes showed for BMS that the concentrations of hydrocarbons and nitrogen oxides was lower than for the use of standard fuel. A study of 164 workers for periods up to 5 years was based on calculation of toxic properties of the components of the mixture. No specific effects on the nervous or visual systems or unusual skin conditions were found. Some psychological concerns were noted, but no neurotic reactions to working with BMS were noted. References 4: 3 Russian, 1 Western.

12672/9835  
CSO: 1841/270

## DETERMINATION OF SERVICE LIFE OF AVIATION LUBRICANTS

Moscow KHIMIYA I TEKHNLOGIYA TOPLIV I MASEL in Russian No 11, Nov 85  
pp 39-40

[Article by V. G. Kuznetsov, G. T. Novosartov, A. I. Yechin and V. N. Bakunin]

[Abstract] Obtaining maximum efficiency from these expensive lubricants requires optimal, scientifically based periods of their use. The most effective method of determining this is evaluating their quality using criteria such as viscosity or the content of additives, an important characteristic of the operating properties of aviation lubricants. A method to do this was developed based on determination of thermo-oxidative stability on a TSM-1 apparatus. This allowed measurement of the content of additives and qualitative properties associated with them during oxidation under laboratory conditions. By developing graphs showing dependence of operating values against time of oxidation, the additive level at which operating properties sharply degrade was determined. This minimum additive content became the criterion for assessing the working capability of the lubricant and determining the limiting length of its service. Thus, for lubricant B-3V, the most important operating characteristics are thermo-oxidative stability and critical loading. Samples were tested for the additives PODFA and kaptaks and for indicators of antioxidative and anti-seizing properties. Experiments showed little change in characteristics during 10 h of oxidation, except that the critical loading decreased from 950 to 600-700 N, indicating that the key variable was the kaptaks additive. Laboratory tests showed that the critical loading began to drop when the kaptaks level fell below 0.2%, so this was taken as the minimal acceptable level. Similarly, for lubricant IPM-10, the most important operating property is its thermooxidative stability. Tests showed that indicators of thermooxidative stability all began to fall when the anti-oxidative additive fell below 0.1%. This approach allows rapid determination of service criteria for any aviation lubricant with critical additives. In a practical test, B-3V lubricant had been changed in the MI-8 helicopter every 200-300 h, although its kaptaks level was still 0.65%; even at 900 hours it had fallen to only 0.36%. This would allow the service life to be tripled, a conclusion verified by determination of physicochemical and operating properties of the lubricant at that point. Figures 2; references 4 (Russian).

12672/9835

CSO: 1841/270

## TECHNICO-ECONOMIC ANALYSIS OF PRODUCTION AND USE OF ALTERNATIVE MOTOR FUELS FROM VARIOUS RAW MATERIALS

Moscow KHIMIYA I TEKHNLOGIYA TOPLIV I MASEL in Russian No 11, Nov 85  
pp 15-18

[Article by G. A. Terentyev, All-Union Scientific Research Institute of Petroleum Refining]

[Abstract] Factors determining the technology and economics of using alternative fuels include the physico-chemical properties and state of aggregation of the raw material, the extraction technology and its costs, the relation of extraction and transport costs, the energy content of the fuel compared to the energy required for extraction, and the compatibility of the fuels with vehicle engines and construction. Petroleum residues, heavy petroleums, and natural bitumens all require extensive processing and hydrogenation. Tar sands, oil shale, and coal also require extensive extraction processing. General Western figures for relative hydrogen consumption, capital investment and operating costs are given for heavy petroleum, tar sands, oil shale, and synthetic petroleum from coal. Use of compressed or liquefied gases also requires extensive and expensive distribution systems. Motor fuels can be obtained by processing feeds that are low quality in terms of C:H ratio and content of heteroatomic compounds, but this requires significant energy expenditures--the thermal coefficient of useful work drops and costs rise. Conversely, however, extraction costs are higher for high quality raw material (petroleum and natural gas). Use costs for the fuels must also be taken into account for economic analysis, increasing relative costs for compressed and liquefied gases and for methanol from natural gas. A general table comparing overall costs of fuel compared to fuel from typical petroleum shows heavy petroleums as 120-150%, oil shales 130-150%, natural gas from 85% (compressed) to 250% (conversion to methanol), and synthetic fuels from coal from 240 to 450% depending on the technology used. References 18 (Russian).

12672/9835  
CSO: 1841/270

ENERGY SAVING EFFICIENCY OF USE OF MTBE [METHYL-TERT-BUTYL ETHER] INSTEAD OF ALKYLATE IN AUTOMOBILE GASOLINES

Moscow KHIMIYA I TEKHNLOGIYA TOPLIV I MASEL in Russian No 11, Nov 85  
pp 7-8

[Article by B. A. Englin, G. A. Terentyev, V. Ye. Yemelyanov and A. M. Vinogradov, All-Union Scientific Research Institute of Petroleum Refining]

[Abstract] While leaded gasoline AI-93 can be obtained from catalytic reforming under normal conditions, unleaded AI-93 requires intensive conditions and the addition of 20-25% alkylate, a very energy-intensive product. Various other approaches could also provide AI-93, at a wide range of costs, including the addition of MTBE. Unlike methanol, this is not poisonous, has a high heat content, is only slightly soluble in water, and is totally miscible with gasoline. AI-93 gasoline can be prepared with gasoline from reforming under intensive conditions (95 octane) by adding 11 wt MTBE and 19 wt % directly distilled fraction (70 octane). This gives a gasoline with an octane number of 93.5 and with a saturated vapor pressure of 61.46 kPa. MTBE does not attack engine components, lowers the cold-starting temperature by 10-12°C, and does not require carburetor adjustment. Comparison of different compositions of AI-93 showed that the use of such oxygen-containing additives as MTBE and methanol are an effective way to obtain high-octane unleaded gasoline.

12672/9835

CSO: 1841/270

## BASIC DIRECTIONS TO SATISFY DEMANDS OF NATIONAL ECONOMY FOR MOTOR FUELS

Moscow KHIMIYA I TEKHNLOGIYA TOPLIV I MASEL in Russian No 11, Nov 85  
pp 2-4

[Article by Ye. D. Radchenko, A. A. Bratkov, D. I. Kondakov, Ye. P. Seregin, V. S. Azev and B. A. Englin]

[Abstract] Demands for motor fuel are almost completely supplied from petroleum, but extraction and transport costs mean that the growth of petroleum production will probably decrease. More efficient refining techniques could improve fuel yields, particularly the use of secondary gas oils with a relatively high content of unsaturated hydrocarbons; however, this can lower the quality of the resulting diesel fuel. The largest potential source of meeting fuel demands is optimizing fuel quality; for gasoline, this means an octane number of about 75 (by motor method). Increasing jet-fuel yield heavily depends on changing requirements for the temperature of its initial crystallization; for example,



raising it from -50 to -40°C can increase the yield by about 35%. Raising the limit of aromatic hydrocarbons in fuels TS-1 and RP from 22 to 25% would also extend supplies. Similarly, decreasing the boiling fraction of summer diesel fuel at 360°C from 96 to 90% would increase reserves by 6-8%. More use could also be made of heavy fuel fractions and benzene in optimizing diesel fuel production. Characteristics can also be improved by using gas oils and additives to lower the cetane number. Improved diesel engines and gasoline carburetors, higher motor compression ratios, and better vehicle design can all reduce fuel consumption. Using more natural gas and coal for energy production at power stations and within petroleum refineries can also increase motor fuel availability. Engines can be developed which basically use low-octane fuel, but add high-octane supplements during periods of high load. Water-fuel emulsions can further lower fuel consumption. Alternative raw materials can also be used depending on their availability and processing requirements. Compressed or liquefied natural gas can be used for motor fuel, methanol additives can extend fuel reserves or be used to produce methyl-tertiary-butyl ether, and synthetic fuels can be produced from coal. Overall, methods to economize and optimize are most attractive because of their low capital requirements. Calculations of an indicator of relative economic effectiveness of capital outlays showed optimization, 11; economizing, 3.6; more sophisticated refining, 1; increase in refining, 0.6; and alternative raw materials, 0.4. The economic effectiveness of oil recovery will probably drop because of large capital requirements of new oilfields. Under these conditions, it may be economical to produce more motor fuels from coal, natural gas, oil shale, biomass, and bitumenized rocks.

12672/9835  
CSO: 1841/270

UDC: [66.094.3:661.7::547.535.1]"614.833.4

#### STUDY OF CONDITIONS OF EXPLOSION-SAFE OXIDATION OF ISOPROPYL BENZENE

Moscow KHIMICHESKAYA PROMYSHLENNOST in Russian No 11, Nov 85 pp 658-659

[Article by N. A. Komarovskiy, O. M. Penkina and A. K. Kobayakov]

[Abstract] Direct oxidation of hydrocarbons can be safe if composition of the reaction mixture remains outside the area of ignition. The authors experimentally determined the boundaries of explosive compositions of oxygen-containing mixtures of isopropyl benzene under conditions similar to those encountered in the process of its oxidation: 150°C, 0.3-0.9 MPa, oxygen content 8-21 vol.%. The limits of oxidation of isopropyl benzene were determined as functions of the content of oxygen and nitrogen in the mixture. The minimum explosive oxygen content is 8.8% throughout the pressure range studied. The excess of isopropyl benzene in the reaction mixture must be great enough that its content in the mixture remains outside the ignition range, and the concentration of oxygen in the mixture must be limited considering the minimum mentioned above plus a safety factor.

6508/9835  
CSO: 1841/213

UDC: 615.281:547.551.525.211.1].012.07

STUDY OF PROCESS OF CHLOROACETALDEHYDE PRODUCTION BY CONTINUOUS METHOD

Moscow KHIMIKO-FARMATSEVTICHESKIY ZHURNAL in Russian Vol 19, No 8, Aug 85  
(manuscript received 14 Mar 84) pp 988-991

[Article by V. V. Popov, Ye. V. Zakharov, N. L. Akopyan, V. Ye. Grebenshchikov, and N. S. Ravinovich, All-Union Scientific Research Chemical-Pharmaceutical Institute imeni S. Ordzhonikidze, Moscow; "Krasnaya Zvezda" Chemical-Pharmaceutical Plant, Kharkov]

[Abstract] Chloroacetaldehyde was produced in a bubbler column filled with water through which chlorine and vinyl chloride were bubbled. The hydrodynamics of the cross-sections of the reactor were analyzed to allow intensification of diffusion processes in the separate phases and at their interface to intensify the reaction rate and heat transfer. Equations were produced to relate the concentration of chloroacetaldehyde in the reaction mixture to the temperature and consumption of liquid. Optimal conditions in the tubular reactor were 10°C, with gas bubbling rate sufficient to yield a thin circular layer of liquid phase around the bubbles. Satisfactory product quality was achieved. Figures 3; references 5 (Russian).

6508/9835

CSO: 1841/229

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ELECTROCHEMICAL REDUCTION OF 1-OXYL-2,2,6,6-TETRAMETHYL-4-OXYIMINOPIPERIDINE

Moscow ELEKTROKHIMIYA in Russian Vol 21, No 10, Oct 85  
(manuscript received 20 Aug 84) pp 1369-1372

[Article by N. P. Bogdanova, L. G. Petrova, I. A. Avrutskaya and M. Ya. Fioshin, (deceased), Moscow Chemical-Technologic Institute imeni D. I. Mendeleyev]

[Abstract] The electrochemical behavior of 1-oxyl-2,2,6,6-tetra-4-oxyiminopiperidine (oxime radical) was studied to determine the possibility

of obtaining electrochemically a stable nitroxyl radical 1-oxyl-2,2,6,6-tetramethyl-4-aminopiperidine (amine radical), which is useful in medicine and biology. The oxime radical was found to be stable with time when kept in 0.1N sulfuric acid in the presence of mercury. Electrolysis of the oxime radical indicates that at -0.6v potential, only the radical fragment is reduced to form the hydroxyamino derivative of the title compound. The oxyimino group is reduced at -1.1 to -1.3v, and therefore the primary electrolysis product is oxyaminopiperidine. Figures 3; references 2 (Russian).

12765/9835

CSO: 1841/200

REVIEW OF RESEARCH WITH MACROMOLECULAR MACROCYCLIC LIGANDS

Moscow ZHURNAL VSESOYUZNOGO KHIMICHESKOGO OBSHCHESTVA IM. D. I. MENDELEYEVA in Russian Vol 30, No 5 Sep-Oct 85 pp 556-562

[Article by Prof S. L. Davydova: "Macromolecular Macrocyclic Ligands"]

[Excerpts] Since Pedersen's (1) discovery of macrocyclic polyethers, 18 years have passed, but interest in this class of compounds not only has not decreased but rather is constantly increasing. During this period of time new natural macrocyclic compounds such as cyclodextrins (2) and membrane-active complexes (3) were isolated. Macrocycles such as cryptands (4) were synthesized, along with other cyclic compounds with heteroatoms of not only nitrogen and oxygen but also sulphur, phosphorus, and others (see 5). Works have been published on noncyclic analogues--pseudomacrocycles called podands (6).

The number of works devoted to the synthesis and study of macromolecular macrocyclic ligands is fairly small, and some information can only be found in reviews. This article presents new information on polymer macrocyclic ligands, and describes properties of them determined by the polymer nature of the substance, thanks to which they are classed in a separate group of compounds. Depending on the distance between the polymer base and the functional group, two types of macromolecular macrocyclic compounds are distinguished (7): polymers whose macrocycles are part of the main chain or located next to it as side groups; and polymers with a long connecting "leg" between the macromolecular skeleton and the macrocyclic function. The review examines polymers of both types; it does not discuss works on macrocycles which are set on an inorganic base of the silica gel type (they are fairly thoroughly described in monograph (8)).

Areas for Application of Polymer Macrocycles and Polypodands

Macromolecular macrocyclic compounds and polypodands are used for the chromatographic separation of cations, anions, salts, and organic substances, for the detection of fixed and retained water, and for the concentration of small quantities of compounds (7, 66). Attempts to use such polymers as well as polypodands in the production of ion-selective electrodes are well known (67). It is possible to use polycrown ethers and cryptands in the Coulometric titration of cations in water and water-methanol mixtures (66). The ability of polycrown ethers to bind organic molecules and ions as well as other macromolecules by forming poly salt complexes can be used for the extraction and removal of organic impurities from water (64). Films based on the polymers in question can be used as membranes for reverse osmosis and ultrafiltration (8).

Polymer macrocyclic compounds exhibit catalytic activity in a number of chemical reactions. The presence of molecular cavities and the fact that they show potential for achieving complementary conformance during reaction determine the substrate specificity of such catalysts and make them similar to enzymes to a great extent. So, polymer cyclodextrins allow one to carry out the selective chlorination of anisole, and they are effective catalysts for the hydrolysis of complex p-nitrophenol ethers (19). Polymer crown ethers, cryptands, and polypodands are good interphase transfer and three-phase catalysts (6). Their catalytic function usually includes the activation of reagents by increasing ion pair dissociation with the formation of reactive undissolved anions and by separating connected ion pairs.

The application of macromolecular macrocyclic compounds in halogen exchange, cyanidation, and allylation reactions is described in (36) and (68). A comparison of the catalytic activity of polymacrocycles and polypodands in the instance of nucleophilic substitution of benzyl chloride with calcium acetate is carried out in (50); the cryptands turned out to be most effective. Polypodands containing oligoethylene glycol monomethyl ether side chains were used as catalysts and cocatalysts in substitution, reduction, and Wittig reactions with dichloro carbene (51). Polyethylene glycol is widely used as a nucleophilic substitution catalyst (21, 40, 47). The use of water-soluble polyvinyl benzo-18-crown-6 (1, n=2) was considered in almost all of these works; the catalytic activity of the polymer includes transfer of the substrate to the aromatic center of a compact macromolecular ball, following the pattern of micellular catalysis (23, 69).

It is entirely possible that sorbents based on these macromolecular macrocyclic compounds are useful for removing various wastes from an organism (70). Polymer macrocycles can serve as models for studying ion transport through membranes (21). A practical interest involves modification of polymacrocycles and podands toward the result of complexing; complexes can have valuable thermostable, optical, and dielectric properties. Recently, works have appeared in which it is proposed to use complexing with ethylene oxide polymers and copolymers for the quantitative analysis of macromolecules; such an analysis is possible with the help of calcium ferrocyanide, for example (58). Polyethylene glycol in blood plasma proteins has been determined spectrophotometrically (59) in the form of  $BaI_2$  complexes. Undoubtedly, other areas of macromolecular macrocyclic ligand application will be found in the very near future.

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UDC 541.64:547.39

#### STUDY OF ACRYLSULFACRINE FORMATION REACTION

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 27, No 11, Nov 85  
(manuscript received 25 Mar 84) pp 2311-2313

[Article by V. Z. Annenkova, V. M. Annenkova, N. P. Shilyayeva and  
M. G. Voronkov, Irkutsk Institute of Organic Chemistry, Siberian Department  
USSR Academy of Sciences]

[Abstract] In previous papers synthesis of bisulfite derivatives of acrolein and acrylic acid copolymers with biological activity was described. A copolymer with a 60:40 ratio of acrolein:acrylic acid monomers, modified with sulfuric acid and NaOH was called acrylsulfacrine and exhibited the highest anticoagulative activity in the series tested. In the present paper, various modifications of this polymer are described. Sulfation with sulfuric acid converted the copolymer into a gel which eventually dissolved. Lyophilization was used to isolate the sulfation products. Neutralization with NaOH to pH 7 converted the product to more stable Na salts. The dried product was a pinkish powder stable on storage, preserving its solubility for over two years. Figure 1; references 7: 4 Russian, 3 Western.

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CSO: 1841/253

UDC 541.64:539.3 + 532.135

#### RHEOLOGIC AND MECHANICAL PROPERTIES OF NORPLASTS BASED ON HIGH DENSITY POLYETHYLENE

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 27, No 11,  
Nov 85 (manuscript received 9 Jan 84) pp 2385-2390

[Article by Yu. G. Yanovskiy, G. V. Vinogradov, M. A. Gevorgyan and  
Yu. M. Sivergin, Institute of Petrochemical Synthesis imeni A. V. Topchiyev,  
USSR Academy of Sciences; Institute of Chemical Physics, USSR Academy of  
Sciences]

[Abstract] Composition materials based on HDPE (high density polyethylene), pearlite and norplast were studied in a wide range of frequencies with

temperature reaching 220°C. Strength characteristics were also evaluated on stretching and compression at 20°. Norplasts are highly active as fillers; they alter extensively rheological characteristics of the system. Based on the analysis of rheological behavior of the composite, one could predict their mechanical properties. For example, a quantitative relationship exists between the modulus of aggregation and the strength characteristics of these reinforced systems. Optimal properties of the solid systems and the melts are reached with a 30-40% content of the filler. Figures 8; references 11: 8 Russian, 3 Western (1 by Russian authors).

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UDC 541.(64+13):542.952

EFFECT OF SOLUBLE POLYMER PRODUCTS (FRACTIONS) ON COATING QUALITY FORMED WITH ELECTROCHEMICAL INITIATION OF N-METHYLOLACRYLAMIDE POLYMERIZATION

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 27, No 11, Nov 85 (manuscript received 3 Apr 84) pp 2370-2375

[Article by L. G. Kolzunova, N. Ya. Kovarskiy and L. M. Novichkova, Institute of Chemistry, Far Eastern Scientific Center, USSR Academy of Sciences and Institute of High Molecular Weight Compounds, USSR Academy of Sciences]

[Abstract] Effect of low molecular weight polymer fractions dissolved in electrolyte on porosity, electroconductivity insulation and maximum thickness was evaluated. An aqueous composition of N-methylolacrylamide--zinc chloride was studied. This composition yields polymethylolacrylamide coatings on metallic cathodes in a wide range of potentials which are partially crosslinked and contain a variable quantity of water-soluble polymer fraction. The dense and thin insulation films are formed at fixed pH and low cathode potential. The results obtained have shown that the above-listed properties are determined by the presence of soluble fractions in the polymer and by the rate of reversible transition into solution. In a constant composition solution, this rate depends on the soluble fraction in the precipitate being formed and does not depend on the cathode material. Figures 6; references 5 (Russian).

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## NEW DEVELOPMENTS IN POLYCONDENSATION

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 27, No 11, Nov 85  
pp 2243-2260

[Article by S. V. Vinogradova, Institute of Heteroorganic Compounds  
imeni A. N. Nesmeyanov, USSR Academy of Sciences]

[Abstract] Polycondensation is one of the most important methods for synthesis of high molecular weight compounds. Polycondensation includes processes of polymer formation based on elementary substitution reactions. In this it differs from polymerization which is based on addition reactions. In this review, the following topics of recent developments in the USSR in the field of polycondensation were covered: equilibrium and nonequilibrium polycondensation; effect of structure of the starting materials; stages of macromolecular growth in polycondensation (initiation of the chain, chain growth and growth termination); new polymers and their reactions. Overall, polycondensation has opened a new approach to many polymers with specifically tailored properties. Further work is developing rapidly in the area of reaction mechanisms, targeted catalysis, control of micro-structural formations and molecular weights of these polymers, and development of new applications ranging from fire retardants to bio-medical applications. References 117: 99 Russian, 18 Western (15 by Russian authors).

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## SPONTANEOUS ELONGATION OF POLYCAPROAMIDE FIBERS FORMED FROM MELT

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 27, No 11, Nov 85  
(manuscript received 30 Mar 84) pp 2320-2326

[Article by P. M. Pakhomov, V. A. Pantayev, B. A. Tsaplin, M. V. Shablygin  
and A. S. Tsegolya, All-Union Scientific Research Institute of Synthetic  
Fibers; Scientific Production Association "KHIMVOLOKNO"]

[Abstract] Under certain conditions, polymer fibers and films can spontaneously undergo elongation along the axis of their orientation. This occurs concurrently with the crystallization process. Structural changes accompanying the process of spontaneous elongation were investigated on freshly-formed polycaproamide (PCA) fibers using IR spectroscopy and x-ray diffraction methods. The greatest changes occurred in temperature range 140-180° and 180-200°C, the elongation reaching 8-12% and 12-16% respectively. It was shown that the cause of this spontaneous elongation

were investigated on freshly-formed polycapraamide (PCA) fibers using IR spectroscopy and x-ray diffraction methods. The greatest changes occurred in temperature range 140-180° and 180-200°C, the elongation reaching 8-12% and 12-16% respectively. It was shown that the cause of this spontaneous elongation is the crystallization of polymer. On the molecular level, this was caused by conformational G-T conversions and orientation of T-segments along the axis of the fiber. The intensity of T-conformational absorption bands increased in the IR spectra while that of the G-conformational absorption decreased. Figures 8; references 20: 11 Russian (1 by Western authors), 9 Western.

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#### RELATIONSHIP BETWEEN THERMODYNAMIC AND ADHESIVE PROPERTIES OF FILLED BINARY POLYMER BLENDS

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 27, No 11, Nov 85 (manuscript received 26 Mar 84) pp 2314-2319

[Article by Yu. S. Ipatov, V. V. Shifrin and O. I. Vasilenko, Institute of High Molecular Weight Compounds Chemistry, UkSSR Academy of Sciences]

[Abstract] In forming hybrid polymer matrixes, question arises of the relationship between thermodynamic and adhesive properties of binary polymer mixtures and the effect of a filler on these properties. This aspect was investigated on a system of PEVP--polyurethane (PU). The PE-PU mixture was found to be thermodynamically incompatible in the melt; introduction of a filler led to greater thermodynamic stability of the system, increased thermodynamic work of adhesion and stronger adhesion to solid surfaces as well as between the components of the binary blend. It was shown that for all compositions of the blend and all contents of the filler, a clear correlation existed between thermodynamic adhesion work and the thermodynamic state of the system. The greatest thermodynamic stability was found with a 20-40% content of PU in the system. Figures 3; references 25: 18 Russian (1 by Western author), 7 Western (3 by Russian authors).

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PROPERTIES OF POLYETHYLENE-KAOLIN COMPOSITES OBTAINED BY POLYMERIZATION OF ETHYLENE ON SURFACES OF KAOLIN PARTICLES TREATED WITH ALUMINUM ORGANIC COMPOUNDS

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 27, No 11, Nov 85  
(manuscript received 6 Mar 84) pp 2274-2280

[Article by N. N. Vlasova, V. I. Sergeyev, P. Ye. Matkovskiy, N. S. Yenikolopyan, A. T. Papoyan, B. Ye. Vostorgov, L. N. Grigorov, S. A. Bukanova, L. O. Bunina, N. S. Kogarko, L. A. Tkachenko and V. V. Smirnov, Division of the Chemical Physics Institute, USSR Academy of Sciences]

[Abstract] In a continuation of development of methods for production of polyethylene-kaolin composites (PEKC), a detailed study was undertaken of the effect of polymerization conditions and other factors on kinetic regulations controlling the consumption of ethylene during polymerization and on the properties of composites obtained by this method. PEKC, with 25-90% degree of filling, formed on the surface of kaolin treated with aluminum organic compounds (AOC) during suspension polymerization of ethylene at 293-373 K and ethylene pressure of 0.3 to 1 MPa. Under an optic microscope, the PEKC particles appeared as associates of a large number of primary particles with much smaller diameter. It was shown to be possible to obtain synthetic composites with any degree of filling desired and excellent physical-mechanical properties by catalytic polymerization of ethylene with AOC activated with titanium, vanadium and/or chromium oxide under mild technological conditions. Figures 2; references 6: 4 Russian, 2 Western.

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## ENHANCEMENT OF IMPACT TOUGHNESS OF PVC DRAINAGE PIPES

Moscow PLASTICHESKIYE MASSY in Russian No 12, Dec 85 pp 9-12

[Article by M. S. Akutin, N. N. Tikhonov, S. R. Braginskiy and F. Deak]

[Abstract] Studies were conducted on the improvement of impact toughness of PVC drainage pipes designated for agricultural use by the addition of butadiene oligomer additives in a PVC:additive weight ratio of 100:2. Analysis of physicomachanical characteristics of the modified PVC samples over a temperature range of 233-293°K indicated that the additives formed a separate phase. Located in unordered areas of the polymer, they favored an increase in the mobility of the polymeric chains and the creation of a more stable and mobile structure. The latter led to the development of plastic rather than brittle deformations on impact and, hence, greater impact resistance. The modified PVC samples showed considerably greater tolerance of low temperatures, indicating that pipes made from such materials can be used in virtually all of the climatic zones of the USSR. Figures 2; references 7: 5 Russian, 2 Western.

12172/9835

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## IMPROVED DRAINAGE PIPES FROM FILLED LOW-DENSITY POLYETHYLENE

Moscow PLASTICHESKIYE MASSY in Russian No 12, Dec 85 pp 12-14

[Article by N. B. Yenikolopova, Ye. D. Lebedeva, T. M. Rogatkina, T. A. Stepanova, R. P. Braginskiy, V. P. Skvortsov and P. P. Sherstnev]

[Abstract] High- and low-molecular weight additives were used in combination with low-density polyethylene (LDPE) to modify relaxation processes in the latter and render it more suitable for production of drainage pipes. The filled LDPE samples were analyzed by differential scanning calorimetry and dynamic mechanical analysis over respective temperature intervals of 0-190 and -150 to 130°C. With 0.3-0.5% of the low MW compound the  $T_g$  decreased by 6°C, indicating increased macromolecular mobility in amorphous regions of the polymer. With 0.8-1.5% of the low MW filler  $T_g$  showed an increase, suggesting denser packing of the macromolecular segments. A further increase in the filler to 3% resulted in reduction of  $T_g$ , suggesting weakening of polymer-filler bonds and increased mobility in the amorphous regions.  $T_g$  is reduced by 2-4°C with 1-3% of high MW filler. With 0.5% of the high MW filler  $T_g$  falls by 7°C and is below the  $T_g$  of unmodified LDPE, indicating shortened relaxation times for the slowest rearrangements of large macromolecular segments. Fillers thus can be seen to markedly

alter the characteristics of LDPE and their suitability for various products. Figures 2; references 5 (Russian).

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#### REPLACEMENT OF METAL BY PLASTIC PIPES

Moscow PLASTICHESKIYE MASSY in Russian No 12, Dec 85 pp 16-17

[Article by Yu. S. Davydov]

[Abstract] An economic analysis is presented of the replacement of metal, usually steel, piping by various plastic pipes. The cost benefit in favor of plastic over steel pipes is at least five-fold. Although largely used for domestic purposes and in agriculture for drainage and water supply, their use can also be extended to various industries as gas pipes and conduits for electric lines. An analysis of 446 construction projects at 11 ministries has shown that in 25% of the case such substitutions can be made, i.e., 335,000 tons of steel tubes and pipes can be replaced by 93,000 tons of plastic pipes.

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UDC 678.742.2.02:62.225

#### MAINTENANCE AND REPAIR OF PIPELINES AND TUBULAR APPARATUS AT HIGH-DENSITY POLYETHYLENE PLANTS

Moscow PLASTICHESKIYE MASSY in Russian No 12, Dec 85 pp 17-18

[Article by A. F. Berman, L. N. Kolosova and V. S. Shubin]

[Abstract] It has been estimated that 60-70% of the breakdowns at high-density polyethylene (HDPE) production plants are due to lack of adequate maintenance and repair of the tubular apparatus and piping. Such systems, however, require careful monitoring because of the physical and chemical factors involved in HDPE production which place considerable strain on the performance of the equipment. Among such factors are high temperatures and rapid changes in temperature, high pressures, various pressure drops, and chemical and electrochemical effects of coolants. Careful monitoring, relying essentially on non-destructive flaw detection by various methods, has been shown to extend the service life of the piping system and equipment for up to 16 years. In addition, it is being suggested that more tube-in-tube type equipment be utilized for better control of escaping gases and

liquids, and that more rigid quality control standards be employed in the manufacture and fabrication of the machinery and equipment used in the production of HDPE. References 9 (Russian).

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UDC 678.674.4.43'42'5.01

#### CATIONIC TELOMERIZATION IN SYNTHESIS OF PEROXIDE OLIGOMERS

Moscow PLASTICHESKIYE MASSY in Russian No 12, Dec 85 pp 21-22

[Article by M. N. Bratychak, V. B. Vostres and V. A. Puchin]

[Abstract] Synthesis of peroxide oligomers was conducted over a temperature range of 20-50°C with a reactant system of ethylene glycol diglycidyl ether (I) with ethylene glycol (II) and tert-butylperoxymethanol (III) as the telogen. Evaluation of results with a molar ratio of I:II:III of 2:1:(1.5-4.0) and 2-8% catalyst (boron trifluoride etherate or stannic chloride) led to the identification of the following as optimal reaction conditions: I:II:III = 2:1:2, 40°C, 4% boron trifluoride etherate, 1 h reaction time. The aliphatic peroxide oligomeric product had a MW of 1400 and consisted of a viscous substance with 2.3% active oxygen. The oligomer was soluble in organic solvents, stable on storage, and could be structured at 110°C and above as a result of disruption of labile -O-O- bonds. Figures 1; references 5: 3 Russian, 2 Western.

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UDC 678.742.3.02"313":66.097

#### PROSPECTS IN POLYPROPYLENE PRODUCTION BASED ON NEW GENERATION OF HIGHLY EFFICIENT CATALYSTS: LITERATURE REVIEW

Moscow PLASTICHESKIYE MASSY in Russian No 12, Dec 85 pp 23-26

[Article by N. P. Shestak, I. A. Voloshin, G. N. Kashirina and S. S. Ivanchev]

[Abstract] A review of largely Western literature is presented on new trends in the production of polypropylene (PP), based on advances in the development of a new generation of highly efficient catalysts. In the 10th Five-Year Plan, Soviet production of PP increased 2.8-fold, while in the 11th Five-Year Plan, a 3.7-fold increase is anticipated. This will come largely as a result of improved catalysts, such as the microspherical

catalysts based on titanium trichloride or titanium-magnesium catalysts on appropriate support. The productivity of the latter type of catalysts exceeds 30 to 350-fold that of the conventional catalysts presently in use, and yields a more stereospecific polymer. Data on a variety of new catalysts are summarized in tabular form with information on solvents, temperatures, pressures and polymerization times. Advances in PP catalysis have required a restructuring of PP production and the construction of new plants to allow polymerization in bulk and in the gaseous state. Figures 2; references 24: 9 Russian, 15 Western.

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#### STRUCTURE OF COMPOSITES RESULTING FROM MECHANICAL MIXTURES OF THERMOPLASTS

Moscow PLASTICHESKIYE MASSY in Russian No 12, Dec 85 pp 37-38

[Article by V. A. Struk and A. A. Voyno]

[Abstract] Physicomechanical and spectroscopic studies were conducted on the structure of composites prepared by mechanical mixing of two thermoplasts using pressure molding technology. The binary systems analyzed consisted of a mixture of the copolymer formaldehyde-dioxolane (FD) with either polyamide-6 (PA-6) or with polyurethane (PU). Studies over a wide range of ratios (FD:PA-6 = 99.9:0.1, 50:50 and 10:90; FD:PU = 90:10, 50:50 and 20:80) demonstrated that the reinforcement effects of FD result from formation of filler aggregates that are uniformly distributed in the polymer bulk. This effect is enhanced by adhesive bonds at the matrix-filler interphase, with IR spectra indicating the formation of  $=N-CH_2O-$  and  $=N-OCH_2-$  bridges, and thermographic data showing a 5-50°C increase in thermodestructive temperatures on addition of 2.5-10% FD. Figures 2; references 10 (Russian).

12172/9835  
CSO: 1841/261

## SHELL-SHAPED ELASTIC MOLDS

Moscow PLASTICHESKIYE MASSY in Russian No 12, Dec 85 pp 48-49

[Article by N. L. Sazanova and L. I. Deberdeyev]

[Abstract] Cursory details and discussion are presented on production of polyurethane items by casting in plastic molds, with the notation that silicone-rubber molds offer a number of advantages other than price of the resin. In view of this, a modification has been proposed which replaces the bulk of the silicone-rubber with supportive, rigid, polyurethane blocks with the appropriate contour. The polyurethane blocks are covered with a polyethylene film to support the model item which is then overlaid with silicone paste to serve as the template for the casting polyurethane. Gates are provided for the casting to reach the silicone layer functioning as the mold. Shell-shaped items are easily produced by this method, which is highly cost effective in the use of silicone. Figures 1; references 6: 4 Russian, 2 Western.

12172/9835

CSO: 1841/261

## POLYMERIC PACKAGING OF CHEMICAL PRODUCTS IN DOMESTIC USE

Moscow PLASTICHESKIYE MASSY in Russian No 12, Dec 85 pp 45-47

[Article by V. N. Krivoshey and R. N. Stepanova]

[Abstract] A minireview is presented of the current status of polymer packaging in the USSR for chemical products used at home. At the present time, such packaging accounts for 41% of all the packaging for domestic chemical products, with a further breakdown revealing that 71% are made from high-density polyethylene, 16% from low-density polyethylene, 8% from polyvinyl chloride, and 5% from polystyrene. Considerable research is being conducted to further improve manufacturing and quality of the product. For example, introduction of high-density polyethylene into gaseous low-density polyethylene to a concentration of 30% has resulted in a 20-25% weight reduction of the packaging with retention of all the desirable characteristics. Other efforts are directed at greater efficiency in the utilization of raw materials and higher productivity, which in the long run will lower the cost of such packaging even further and lead to its even wider use. Figures 1; references 12 (Russian).

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## TOUGHENING POLYCARBONATE ITEMS

Moscow PLASTICHESKIYE MASSY in Russian No 12, Dec 85 p 52

[Article by A. A. Shturman and T. I. Reznichenko]

[Abstract] In view of the tendency of items fabricated from polycarbonate to crack in use or from other type of strain, studies were conducted on the toughening of Diflon polycarbonate samples by treatment with GKZh-94 organo-silicon liquid solution. Trials with 30-180 min treatments at 130-150°C demonstrated that optimal gain in toughness, wearability, water resistance and prevention of cracking was obtained with 2 h treatment at 130°C with samples 3 mm thick. The optimal treatment time for samples of polycarbonate less than 3 mm thick was found to be in the range of 0.5-1 h. Figures 1.

12172/9835

CSO: 1841/261

UDC 532.72:541.67

## DETERMINING COEFFICIENT OF DIFFUSION OF ACIDS INTO ELECTRODES OF POLYMERIC MATERIALS

Ivanovo IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: KHIMIYA I KHIMICHESKAYA TEKHNOLOGIYA in Russian Vol 28, No 10, Oct 85 (manuscript received 13 Feb 84) pp 120-122

[Article by A. A. Shevchenko, V. P. Starikov and N. G. Kats, Department of Machines and Equipment for Chemical Production, Moscow Institute of Chemical Machine-Building, Kuybyshev Polytechnic Institute]

[Abstract] This paper describes a method of determining the coefficient of diffusion by measuring the electrochemical potential at the electrode surface. Results were compared with gravimetric determinations for a silver-chlorine electrode in sulfuric, hydrochloric and acetic acids (concentrations of 5 to 50%) at temperatures of 20-60° C with a graphite-filled polymeric material using a furan binder DG-2. The gravimetric measurements verified that Fick's Law applied over the intervals studied. Electrochemical measurements showed that a fixed voltage was reached within 24 hr. The coefficients of diffusion showed a linear relationship to electrochemical potential when plotted on semilogarithmic coordinates. Equations are provided to calculate a constant energy of activation based on the measured electrochemical potential--values are given as 12000, 15500, and 13100 J/mole for the sulfuric, hydrochloric and acetic acid systems evaluated. A pre-exponential multiplier can be determined by relatively simple sorption measurements. Then the coefficient of diffusion can be directly calculated with an accuracy of  $\pm 10\%$ . Figures 2; references 3 (Russian).

12672/9835

CSO: 1841/255

## POLYMERIZATION OF MONOMER QUATERNARY SALT 1,2-DIMETHYL-5-VINYLPYRIDINYLMETHYLSULFATE IN PRESENCE OF POTASSIUM PERSULFATE

Ivanovo IZVESTIYA VYSSHIKH UCHEBNIKH ZAVEDENIY: KHIMIYA I KHIMICHESKAYA  
TEKHNOLOGIYA in Russian Vol 28, No 10, Oct 85  
(manuscript received 5 May 84) pp 95-98

[Article by K. A. Chulpanov and A. T. Dzhalilov, Department of Plastic  
Processing Technology, Tashkent Polytechnic Institute]

[Abstract] This paper presents investigations of the kinetics of polymerization of 1,2-dimethyl-5-vinylpyridiniummethylsulfate in the presence of potassium persulfate in water at 298-313°C. The polymers were white powders soluble in water, dimethylformamide, and alcohol. Samples were precipitated from acetone, dried, and subjected to paramagnetic resonance (PMR) spectroscopy and viscosimetric measurements. Kinetics were studied with the initiator ranging from 0.011 to 0.044 moles/l and the salt from 1.22 to 4.76 moles/l. Reaction speed increased with increasing salt concentration (initiator concentration held constant) and with increasing initiator concentration (salt concentration held constant). It was represented by the equation  $W = k[I]^{0.5} \times [M]^{1.76}$  where M is the concentration of the monomer and I the concentration of the initiator. Polymerization also increased with temperature. The energy of activation for the polymerization was 56.6 kJ/mole. The initiation was apparently an oxidation-reduction mechanism, with the monomer acting as a reducing agent and the initiator as an oxidizer. PMR indicated that polymerization took place at the vinyl double bond. The solutions showed the intrinsic viscosity rising in dilute solutions, a typical characteristic of polyelectrolyte solutions; this shifted to a linear dependence when a strong, low-molecular weight electrolyte, such as potassium chloride, was added to the solution. Figures 4; references 3: 1 Russian, 2 Western.

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## KINETICS OF PLASMA DEPOSITION OF FLUOROCARBON FILMS IN PRESENCE OF AMMONIA

Moscow KHIMIYA VYSOKIKH ENERGIY in Russian Vol 19, No 6, Nov-Dec 85  
(manuscript received 3 Jul 84) pp 541-543

[Article by L. A. Tikhomirov, Institute of Chemical Physics, USSR Academy of Sciences]

[Abstract] This paper presents results of experiments on the kinetics of plasma deposition on polytetrafluoroethylene samples of polymeric fluorocarbon films using  $C_2F_4$ , perfluorokerosene, and  $C_2F_4Br_2$  in the presence of ammonia. Sample films 11 X 6 X 0.00083 cm were suspended between electrodes, the pressure dropped to 1.0 Pa, and then a stream of ammonia at a specified pressure was supplied, followed by a stream of the fluorocarbon agent. The total pressure of the mix was 13.3 Pa, with the partial pressure of the ammonia varying from 0 to 11 Pa. Once the gas streams were established, an electrical discharge was produced, with an average strength of about  $10 \text{ kW/m}^2$ , for 2 h. The deposition rate varied nearly in proportion to the pressure of the fluorocarbon agent. For the three agents at a pressures of 13.3 Pa, the reaction speeds were 1.5, 1.0 and  $4.0 \times 10^{-8} \text{ kg/s}$  respectively, with low deposition rates attributed to destructive processes based on interaction of the fluorocarbon agents with oxygen and with released fluorine. Peroxide radicals were also effectively destroyed by the ultraviolet radiation and electrons present in the plasma, producing  $CF_2O$  in a chain reaction. The addition of ammonia, apparently binding free F and Br, increased the deposition rate 2-3 times for  $C_2F_4$  and perfluorokerosene. For the  $C_2F_4Br_2$ , the deposition rate increased approximately 10 times at an ammonia partial pressure of 7-8 Pa; at higher concentrations of the fluorocarbon agent, the ammonia was apparently insufficient to bind all the free Br and the rate dropped. Figures 3; references 18: 5 Russian, 13 Western.

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CSO: 1841/254

## INFLUENCE OF FILLERS ON PHASE STATE OF MULTI-COMPONENT POLYMER SYSTEMS

Kiev DOKLADY AKADEMII NAUK UKRAINSKOY SSR: SERIYA B: GEOLOGICHESKIYE, KHIMICHESKIY I BIOLOGICHESKIYE NAUKI in Russian No 11, Nov 85  
(manuscript received 12 Jul 85) pp 44-48

[Article by Yu. S. Lipatov, academician, UkSSR Academy of Sciences, M. P. Gudima, A. Ye. Nesterov and T. S. Khranova, Institute of High-Molecular Weight Compound Chemistry, UkSSR Academy of Sciences, Kiev]

[Abstract] The influence of the surface of a solid (aerosil) on phase equilibrium in ternary polymer-polymer-solvent systems is studied for the

first time. The influence of selective adsorption of components in the polymer-polymer solvent filler system on the thermodynamic stability of ternary polymer-polymer filler mixtures obtained from 4-component systems after removal of the solvent is experimentally demonstrated for the first time. The objects studies were mixtures of polystyrene with polybutyl methacrylate. Experimental data indicate that in the presence of dispersed particles in a mixture of two polydispersed polymers, there is an increase in the thermodynamic stability of binary polymer-polymer systems. The introduction of dispersed particles to the ternary polymer-polymer solvent system also causes expansion of the area of mutual solubility of the polymer strand. This effect is explained by the adsorption interaction of the components of the mixture with the surface of the filler. Figures 3; references 15: 7 Russian, 8 Western.

6508/9835

CSO: 1841/231

#### INITIATOR AND INHIBITOR OF PVC

Moscow KHIMIYA I ZHIZN Vol 250, No 10, Oct 85 pp 46

[Unsigned]

[Abstract] This article, extracted from Doklady AN SSSR, Vol 282, No 1, p 112, reports on a suggestion by a group of Soviet researchers to use, as initiator in the process of production of polyvinyl chloride, a substance capable of acting as a weak polymerization inhibitor as well. Peroxycarbonates containing unsaturated alcohol groups with mobile hydrogen atoms in the allyl position are suggested. The hydrogen atoms can separate when the molecules collide with an active radical and hinder its growth. The results of using one such initiator di(norbornylene-5-methylene) peroxydicarbonate indicate that the process occurs smoothly, with reaction rate decreasing only at the end when there are practically no monomers left in the reactor.

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CSO: 1841/249

## STRUCTURAL MODIFICATION OF POLYMER MATERIALS WITH PHOSPHORUS-VANADIUM-CONTAINING FIRE RETARDANTS

Moscow PLASTICHESKIYE MASSY in Russian No 11, Nov 85 pp 56-57

[Article by V. I. Kodolov, L. F. Knyazeva, G. S. Khramaya, V. I. Mikhaylov, V. I. Povstugar and V. K. Kibenko]

[Abstract] Systems containing phosphorus and vanadium are better fire retardants than those with phosphorus alone. A 5% concentration of P-V systems was used (based on the materials studied: epoxy resins, rubbers and polyamides as well as ABC-PVC copolymers) in evaluating this concept. Indeed, it was shown that structural modification of polymers with P-V systems decreased their flammability and improved physical-mechanical properties. However, careful preliminary evaluation must be made to determine specific structure for active fire retardant systems. Figure 1; references 5 (Russian).

7813/9835

CSO: 1841/259

## PYROLYSIS OF SILICONORGANIC BINDERS FOR CARBON-CARBON COMPOSITIONS

Moscow PLASTICHESKIYE MASSY in Russian No 11, Nov 85 pp 24-26

[Article by V. I. Rezanov, T. V. Vasilyeva, N. M. Petrovnina and V. A. Babicheva]

[Abstract] Pyrolysis of polyorganosiloxanes used as binders in carbon compositions was studied as a function of composition and structure. The polymers were evaluated: one with a 21:1 ratio of carbon:silicon atoms and another with a 1:1 ratio. The entire process could be divided into two zones: the initial period (200-500°C) in which intensive destruction processes occur along with polycondensation of the functional groups  $C_6H_4OH$ ,  $SiOH$  and  $SiOC_4H_9$ . Considerable loss of sample mass takes place with formation of low molecular weight neutral molecules  $H_2O$ ,  $H_2$ ,  $C_4H_9OH$ , etc. In the second zone (above 500°C), coking is observed along with thermal destruction of the sample. Overall, it was shown that the structure of carbonized polymer residue depends on the structure of starting binder: increased content of silicon in the binder along with its decreased tendency towards coking leads to higher number of open pores in the carbonized composition. Figures 2; references 7: 6 Russian, 1 Western.

7813/9835

CSO: 1841/259

## MODIFICATION OF WATER SOLUBLE POLYMERS AND HYDROGEL MEMBRANES BASED ON PRODUCTS OF THEIR SYNTHESIS

Moscow PLASTICHESKIYE MASSY in Russian No 11, Nov 85 pp 27-29

[Article by O. V. Suberlyak, O. S. Zaikina, I. G. Tkhir and A. I. Soshko]

[Abstract] The principal deficiency of electrolytic membranes is their low thermochemical stability. In an attempt to expand the assortment of highly permeable polymer materials with improved physical-mechanical properties, grafted copolymers were synthesized on the basis of ethylene glycol monomethacrylate and water-soluble polyvinylpyrrolidone and polyvinyl alcohol. In addition, copolymers consisting of ethylene glycol monomethacrylate + polyvinyl pyrrolidone + oligoesterdimethacrylate were obtained. These copolymers exhibited high heat stability, surface hardness and elasticity in a swollen state. To improve their brittleness, they were modified with oligomeric dimethacrylates. Modification of polyvinyl alcohol with monomers could be performed directly in the film resulting in a latticed polymer capable of uniform swelling in water and alcohols. These hydrogel membranes with improved heat stability and permeability to low molecular weight, water-soluble substances could be used to isolate and determine high molecular weight compounds concentrating from them various solutions. Figures 1; references 7: 6 Russian, 1 Western.

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UDC 678-13:547.339.211:547.538.141.029.72

## EFFECT OF CLIMATIC CONDITIONS ON MECHANICAL AND ELECTROPHYSICAL PROPERTIES OF ABC PLASTIC

Moscow PLASTICHESKIYE MASSY in Russian No 11, Nov 85 pp 36-37

[Article by I. E. Seytablayev, Ya. R. Gun, L. D. Koltunova, V. V. Lavrentyev and B. Tsoy]

[Abstract] Alteration in mechanical and electrophysical properties of ABC plastic used under conditions prevailing in Tajik SSR was investigated. Industrial samples of ABC plastic brand 2000 were evaluated during 12 months period on open stationary platforms placed at different altitudes over sea level. During aging, the dimensions of microcracks in these test samples changed because of the breaks in polymer chains. The worst cracks occurred at 800 and 1700 meters above the sea level. The strength of the test samples was related to the coefficient of tension concentration ( $\beta$ ). Increase in  $\beta$  and in the size of cracks indicated polymer destruction

due to air oxygen, temperature, moisture and solar radiation because under normal storage conditions  $\beta$  should remain constant. Overall, the sample strength depended on the state of their surface. Figure 1; references 11: 10 Russian, 1 Western.

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UDC 678.743.22:537

#### CALCULATION OF SPECIFIC VOLUME ELECTRIC RESISTANCE OF PLASTICIZED PVC

Moscow PLASTICHESKIYE MASSY in Russian No 11, Nov 85 pp 19-20

[Article by O. K. Barashkov and R. S. Barshteyn]

[Abstract] Specific volume electric resistance ( $\rho_v$ ) of plasticized polyvinylchloride (PVC) is one of the more important indexes determining the range of its application. In general, temperature and the nature and content of the plasticizer affect the value of  $\rho_v$ . Theoretical analysis and several equations applicable to this system are reported. It was shown that Williams-Landel-Ferri equation, using a physically reliable model, described the relationship between  $\rho_v$  and the content of plasticizer and temperature. Another equation was developed for calculation of  $\lg \rho_v$  of a plasticized PVC under conditions that  $\lg \rho_v < 15$ . Figures 3; references 11: 7 Russian (1 by Western author), 4 Western (1 by Russian authors).

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#### EFFECT OF ANTIMONY OXIDE PROPERTIES ON QUALITY OF POLYOLEFIN COMPOSITION WITH DECREASED FLAMMABILITY

Moscow PLASTICHESKIYE MASSY in Russian No 11, Nov 85 pp 57-59

[Article by D. G. Besarab, S. S. Fedeyev, N. S. Nesmerchuk, V. V. Bogdanova, U. M. Kurkchi, and A. I. Lesnikovich]

[Abstract] Antimony oxide is used widely as a synergist of halogen containing antipyrenes in production of polyolefin compositions with reduced flammability. Fire retardant property and thermal stability of such compositions were studied as a function of antimony oxide properties which could exist as hydrolytic oxides--a rhombic modification valentinite, as pyrolytic oxide--cubic modification senarmontite or as a technical mixture of both of these modifications. High density polyethylene (HDPE) by itself

is flammable and has low thermal stability. Introduction of antimony oxide changes these characteristics, the best results in thermal stability being obtained with the pyrolytic oxide. Evidently, presence of cubic antimony oxide which binds hydrogen halide at 200°C improves the stability of HDPE. Flammability is also affected; the highest HDPE flammability was observed with hydrolytic antimony oxide additive. In order to obtain polyethylene compositions with high thermal stability and non-flammability, antimony oxide should be used with cubic modification and maximum degree of dispersion. Figure 1; references 4: 3 Russian, 1 Western.

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UDC 678.643.425.033:620.193.8

#### BIODEGRADATION OF EPOXYPOLYMERS (REVIEW)

Moscow PLASTICHESKIYE MASSY in Russian No 11, Nov 85 pp 32-34

[Abstract] Epoxypolymers are highly stable chemicals with good adhesive, dielectric, anticorrosive and sealing properties. Practical use of such materials depends on various biological factors including action of water, bacteria and fungi, especially in regions of hot temperatures and high humidity. A review of literature was presented on various aspects of biodegradation of polymers, protective measures, mechanism of action, etc. Analysis of the data showed that biodegradation is a complex physical, chemical and biological process relating to various environmental factors such as the breakdown products of organic compounds, microorganism metabolites, etc. In solving this problem, the first task is to determine the relationship between the initial structure of the polymer, metabolite sorption by the polymer, structural changes resulting from this and determination of the mechanisms of degradation. For the epoxy polymers, many of these questions still need to be answered. References 45: 41 Russian, 4 Western.

7813/9835

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## FORMATION OF EQUIPMENT PARTS FROM COMPOSITION MATERIALS

Moscow PLASTICHESKIYE MASSY in Russian No 11, Nov 85 pp 41-43

[Article by Yu. N. Smirnov, T. Ye. Shatskaya, V. I. Natrusov, V. A. Lapitskiy, B. A. Rozenberg and N. S. Yenikolopyan]

[Abstract] Formation of various component parts from compositions is a rather recent innovation which generated new approaches and requirements in this field. Binders became an important factor considering their longevity, storage temperature and solidification under diverse conditions. A new method for preparation of preimpregnated, reinforced materials was discussed based on separated deposition of the binding components on reinforcing elements followed by their amalgamation (the so called RNK method). Several advantages of this method were listed along with physical-chemical properties of materials prepared by this method. The unique property of the RNK method is its ability to alter physical-mechanical properties of the compositions by regulating the thickness and the structure of the reinforcers. The RNK method makes it possible to produce plexiglass materials based on UTS-0,22 fiberglass equivalent in their properties or surpassing the plexiglass produced by traditional methods. Figures 2; references 3 (Russian).

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UDC 678.746.22-136.676.216.4:677.862.25

## INFLUENCE OF SMALL ADDITIONS OF BLOCK-COPOLYMERS ON THERMAL COPOLYMERIZATION OF STYRENE WITH RUBBER

Moscow PLASTICHESKIYE MASSY in Russian No 11, Nov 85 pp 4-6

[Article by N. A. Noskova, V. D. Yenalyev, V. M. Bulatova, A. N. Shelest, O. P. Shmeleva and V. T. Voloshkina]

[Abstract] Grafted copolymers play an important role in strengthening various composition materials. Effect of small additions of thermoelastoplastics (TEP) to the starting composition of polymers on their structure and physical-chemical properties and morphology was studied while preparing impact resistant polystyrene (IRP) by thermal copolymerization of styrene with polybutadiene rubber (PBR). It was established that the role of block-copolymers in improving IRP increased with increasing molecular weight of polystyrene blocks regardless of the composition of TEP. A possible mechanism was proposed for the formation of IRP. It was shown that in this thermal process for IRP in which small quantities of block-copolymers were added to the composition, the volume of the rubber phase could increase by 10-20%. Figures 2; references 9: 5 Russian, 4 Western.

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THERMOOXIDATIVE STABILITY OF  $\gamma$ -IRRADIATED SOOT-FILLED PE IN PRESENCE OF VARIOUS ANTIOXIDANTS

Moscow PLASTICHESKIYE MASSY in Russian No 11, Nov 85 pp 23-24

[Article by G. A. Burukhina, S. M. Berlyant and V. P. Pleshanov]

[Abstract] Radiation modification of polyethylene (PE) extended considerably the temperature range of its utilization. To help stabilize PE, various antioxidants are added, based on breaking the oxidation chain reaction or on direct reactions with various peroxides. Soot added in quantities of 3% and higher is also an effective antioxidant even in face of high  $\gamma$ -radiation doses, its action resulting from being able to break the chain reaction. Combined action of soot and amine, phenol and sulfide type antioxidants was studied on thermooxidation of radiation modified PE. The results showed that concurrent use of soot and N-phenyl-N'-cyclohexyl-p-phenylenediamine (PCPD) or 2,2-methylene-bis-(4-methyl-6-tert-butylphenol) (MBP) was not advisable because thermooxidative stability of PE is lower than the stability of PE filled with soot alone. This was due to adsorption and decomposition of the antioxidant on the surface of soot particles. Thermal oxidation stability increased considerably when soot was used with  $10^{-3}$  to  $2 \cdot 10^{-2}$  mole/kg of dilauryl ester of thiodipropionic acid (DLTP) showing a synergistic effect, increasing with increased amounts of the fillers. This effect could be explained by the fact that soot acted as a phenol stabilizer, breaking the oxidation chain and DLTP broke down the hydroperoxide molecules without forming free radicals. References 8: 5 Russian, 3 Western.

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UDC 678.5:621.81

## REPLACEMENT OF METAL ITEMS BY PLASTIC PARTS

Moscow KHIMICHESKOYE I NEFTYANOYE MASHINOSTROYENIYE in Russian No 11, Nov 85 pp 37-38

[Article by Z. P. Shirokova, candidate of technical sciences, and N. I. Pershina, R. P. Kolesnikova and R. I. Vycherova, engineers]

[Abstract] Use of parts fabricated from various plastics has been successful in many instances in replacing more expensive metal parts, such as flanges, rollers, piping, coils, etc. The selection of the appropriate polymer or copolymer is based on the use to which it is to be put, chemical exposure, and physical conditions. In 1984 VNIIRT [expansion unknown] designed and produced some 2597 plastic parts, which resulted in an

annual savings of 23,600 rubles. Advances have also been made in the design of machinery for the production of parts from plastic, such as a vertical hydraulic press for extrusions made for polyamide-6. References 1 (Russian).

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UDC: 641.64:537.311

#### SYNTHESIS OF POLYAROMATIC COMPLEXES WITH IODINE

Yerevan ARMYANSKIY KHIMICHESKIY ZHURNAL in Russian Vol 38, No 9, Sep 85  
(manuscript received 18 Apr 84) pp 590-594

[Article by A. A. Matnishyan, A. M. Arzumanyan, L. S. Grigoryan, V. N. Nikogosov, I. L. Arutyunyan, S. G. Grigoryan, R. S. Assatryan, T. M. Ayvazyan, A. L. Manukyan and R. O. Matevossyan, Armenian Affiliate, All-Union Scientific Research Institute of Chemical Reagents and Highly Pure Chemical Substances, Yerevan]

[Abstract] A study was made of the structure and synthesis of polyaromatic complexes with iodine, which have been found to have semiconductor properties, based on naphthalene, anthracene and other aromatic hydrocarbons. The content of iodine in the polymer complex increases with increasing reaction temperature from 3% to 33%. The yield of polymer increases in the sequence benzene, naphthalene, anthracene, naphthacene, phenanthrene. One monomer molecule upon polycondensation yields four hydrogen atoms. Iodine is primarily present as ion-radical salts. The new series of aromatic polymers synthesized contain an acceptor with semiconductor properties, have good stability in air and good resistance to heat. The structure and properties of the materials synthesized are noted. Figures 4.

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RADIOLYSIS OF MIXTURES OF CO<sub>2</sub> and H<sub>2</sub>O

Moscow KHIMIYA VYSOKIKH ENERGIY in Russian Vol 19, No 6, Nov-Dec 85  
(manuscript received 17 Apr 84) pp 556-557

[Article by M. A. Kurbanov, V. R. Rustamov, B. G. Dzantiyev and  
Z. I. Iskenderova, Department of Radiation Research AzSSR Academy of  
Sciences]

[Abstract] Radiolysis of mixtures with 0-90% water vapor was carried out in pyrex and quartz ampules to determine the feasibility of simultaneously producing CO and H<sub>2</sub> by  $\gamma$ -radiation at temperatures of 40-650°C. Mixtures with 1-5 vol % water vapor formed H<sub>2</sub> with a yield of  $0.6 \pm 0.1$  molecules/100 eV. There was a tendency for H<sub>2</sub> to reach a saturation level of about  $6 \times 10^{15}$  molecule/cm<sup>3</sup>, with only traces of CO present. Apparently the H<sub>2</sub> is formed by the reaction of CO with -OH radicals, which agrees with rates of CO formation by radiolysis of pure CO<sub>2</sub>. Increasing temperature increased the CO yield, probably by increasing the reaction rate of atomic oxygen with CO<sub>2</sub>. In the presence of water vapor, this reaction apparently competed with the reaction of atomic oxygen and H<sub>2</sub>O; therefore, increasing the proportion of water vapor generally decreased the CO and increased the H<sub>2</sub> yield. This dependence of CO on water vapor content was relatively weak at higher temperatures, an effect attributed to higher activity of atomic hydrogen. Figures 1; references 6: 4 Russian, 2 Western.

12672/9835

CSO: 1841/254

THERMO- AND PHOTO-INDUCED POSTRADIATION FORMATION AND DESTRUCTION OF  
PEROXY RADICALS IN QUARTZ GLASS

Leningrad FIZIKA I KHIMIYA STEKLA in Russian Vol 11, No 5, Sep-Oct 85  
(manuscript received 1 Feb 84) pp 613-615

[Article by A. V. Amosov, L. S. Korniyenko, I. O. Morozova,  
A. O. Rybaltovskiy and P. V. Chernov, Scientific Research Institute  
of Nuclear Physics; Moscow State University imeni M. V. Lomonosov]

[Abstract] ESR and thermoluminescent studies were conducted on highly pure quartz glass to study formation and destruction of peroxy radicals under the effects of gamma irradiation and mercury lamp illumination. Gamma irradiation from a Co-60 source was conducted at 77 and 300 K, followed by illumination. Analysis of the ESR signals and thermoluminescence curves showed that the experimental data were best explained by a peroxy radical model based on dissolved  $O_2$  molecules in the lattice of the quartz glass [Griscom, DL, et al., Phys. Rev., B, 24(8):4896-4898, 1981; Amosov, AV, Fiz. i Khim. Stekla, 9(5): 569-583, 1983]. The appearance and disappearance of ESR signals and the thermoluminescent patterns was interpreted in terms of migration of the oxygen molecules and adsorption to  $E'$  centers ( $\equiv Si$ ) both during irradiation and on heating of the irradiated samples, transforming them into peroxy radicals:  $\equiv Si^\cdot + O_2 \rightarrow \equiv Si-O-O^\cdot$ . Formation of the radicals involves redistribution of the unpaired spin density to the  $O_2$  molecule and formation of  $\equiv Si^+-O_2^-$  centers. On breakage of the  $\equiv Si^+-O_2^-$  bonds by UV quanta  $O_2^-$  is removed from the  $\equiv Si^+$ , and enters a new state which does not produce an ESR signal. The lack of an ESR signal can be attributed either to a change in the spin-lattice relaxation time of the  $O_2^-$  center in the new state, or to the formation of a bound state with some other atom or ion, e.g., formation of  $[ClO_2]^-$ . Similarly, the failure of hydrogen saturated quartz glass samples to produce ESR signals on irradiation may be due to chemical combination of oxygen and hydrogen. Figures 2; references 12: 6 Russian, 6 Western.

12172/9835

CSO: 1841/266

## REVERSIBLE STRUCTURAL CHANGES IN VITREOUS AsSe INDUCED BY GAMMA-IRRADIATION

Leningrad FIZIKA I KHIMIYA STEKLA in Russian Vol 11, No 5, Sep-Oct 85  
(manuscript received 27 Jun 84) pp 595-597

[Article by I. A. Domoryad, B. T. Kolomiyets, V. M. Lyubin and V. P. Shilo,  
Physicotechnical Institute imeni A. F. Ioffe, USSR Academy of Sciences,  
Leningrad]

[Abstract] Various doses of gamma irradiation from a Co-60 source (ca. 750 R/sec, maximum dose ca.  $1.5 \times 10^8$  R) were tested for their effects on the hardness of 0.25-1.0  $\mu$ m thick AsSe films and solubility in NaOH. During irradiation in sealed, evacuated ampules the temperature of the samples did not rise above 35°C. As a result of irradiation, hardness of the samples increases linearly to a dose of ca.  $10^8$  R, reaching a plateau thereafter. Analysis of changes in hardness after repeated irradiation-annealing (60-180°C) cycles demonstrated that the gamma radiation-induced changes were reversible. Analysis of dose-effect plots in terms of solubility in NaOH showed an inverse relationship between dose and solubility. Measurements of solubilization kinetics showed reversibility of the effects of irradiation. As the annealing temperature increased, the rate of solubilization of the irradiated samples increased to that of the control samples, with repeat irradiation again leading to a decrease in the rate of solubilization. These observations were analogous to the reversible changes reported for a number of other physical factors. Figures 2; references 10: 6 Russian, 4 Western.

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CSO: 1841/266

## LASER METHOD TO MEASURE RATE OF HEAT EMISSION DURING CHEMICAL PROCESSES

Moscow TEPILOFIZIKA VYSOKIKH TEMPERATUR in Russian Vol 23, No 6, Nov-Dec 85  
(manuscript received 13 Oct 84) pp 1178-1186

[Article by S. B. Dorofeyev, A. O. Nazaryan, V. G. Plyukhin and B. M. Smirnov,  
Institute of Thermophysics, Siberian Department, USSR Academy of Sciences]

[Abstract] Impurities in coals and other combustibles have a major impact on ignition parameters. The present article reports on study of concrete examples of heat emission during the decomposition of ozone, nitromethane, nitrobenzene and nitrocumene absorbed in activated coal. A specimen was attached to a thermocouple in a chamber and heated by laser irradiation with aluminum monocrystals with 1.06  $\mu$ m wave length. Temperature measurements were made of the specimen itself and of gases in its vicinity.

Then heat emission parameters were calculated. Results showed that temperature and duration of decomposition must both be taken into account in making such calculations. The laser used was not found suitable for such testing of spheres, since its irradiation was somewhat irregular. Thus, tablets were used as specimens in later tests, with acceptable success. Results indicated that decomposition of nitromethane, nitrobenzene and nitrocumene in the given temperature range took place at about twice the rate of the basic activated coal. Mean heat emission for nitrobenzene and nitrocumene was  $2.3 \pm 0.3$  and  $2.1 \pm 0.4$  kilojoules/gram, respectively. Nitro-groups apparently reacted with the benzene ring in that variant, while the presence of  $(\text{CH}_3)_2\text{CH}$  in nitrocumene had no effect on the chemical process. Figures 5; references 12: 9 Russian, 3 Western.

12131/9835

CSO: 1841/264

UDC 533.924+541.1

ACTION OF GAS-DISCHARGE PLASMA ON [SYNTHETIC] RUBBER SKN-26

Moscow KHIMIYA VYSOKIKH ENERGIY in Russian Vol 19, No 6, Nov-Dec 85  
(manuscript received 3 Jul 84) pp 544-547

[Article by Zh. S. Chichagova and L. A. Tikhomirov, Institute of Chemical Physics, USSR Academy of Sciences]

[Abstract] This paper presents results of experiments on the kinetics of surface destruction and cross-linking of butadiene-nitrile rubber SKN-26 in oxygen, air, and ammonia plasmas. Film samples with thicknesses of 10-90  $\mu\text{m}$  were prepared in a duralumin ring with an internal diameter of 3 cm. These were suspended between two electrodes in a glass reaction chamber which allowed continuous sample rotation by means of magnetic coupling of the holder to an exterior motor. Gas streams were established at pressures of 4.0 and 13.3 Pa and speeds of 5.0 and 17.0  $\text{cm}^3/\text{s}$  respectively. Discharges were at a frequency of 50 Hz, a voltage of 900-1200 V, and a current of  $5-50 \times 10^{-3}$  A. The depth of the surface destruction was indicated by sample weight loss, while the weight of the portion insoluble in benzene indicated the amount of cross-linking. The depth of destruction increased linearly with time and also depended on the type of gas, the pressure, and the average power level. The greatest rate of destruction was observed in the oxygen plasma, with water, CO,  $\text{N}_2$  and  $\text{CO}_2$  among the products, as well as a background film formed from vapors of the vacuum grease and of dissociation products of the SKN-26. The rate of cross-linking gradually declined to zero as the depth of this layer reached a maximum of 3.4 to 12.5  $\mu\text{m}$ , apparently due to the limits of penetration of the ultraviolet radiation from the plasma; one anomalous case was observed for an air plasma at a pressure of 4.0 Pa where the depth reached a maximum of 6.5  $\mu\text{m}$  and then unexplainedly declined to 3.4  $\mu\text{m}$ . Generally, the depth of cross-linking increased with increases in pressure or power levels. Overall, the rate of cross-linking greatly exceeded the rate of destruction for plasmolysis of SKN-26. Infrared spectroscopy indicates that oxygen plasma added -CO groups into the SKN-26, while ammonia plasma added NH and  $\text{NH}_2$  groups. Figures 3; references 11: 6 Russian, 5 Western.

12672/9835

CSO: 1841/254



## THERMOMECHANICAL PROPERTIES OF STABILIZED POLYMERIC SULFUR

Ivanovo IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: KHIMIYA I KHIMICHESKAYA  
TEKHNOLOGIYA in Russian Vol 28, No 10, Oct 85 (manuscript received 7 May 84)  
pp 76-79

[Article by V. V. Markov, S. A. Reznichenko and Yu. V. Yevreinov, Department  
of the Chemistry and Physics of Polymers and Processes of Their Modification,  
Moscow Institute of Fine Chemical Technology imeni M. V. Lomonosov]

[Abstract] Stabilized polymeric sulfur is a potential nonblooming vulcanizing agent for the tire industry. This paper presents results of thermomechanical studies of polymeric sulfur taken from melts stabilized with hexachloro-para-xylene; soluble allotropic forms were first extracted with trichloroethylene. For samples without stabilizer, and with 1 and 3 parts stabilizer per 100 parts sulfur, molecular weights were 60, 5 and  $3 \times 10^3$  respectively. Samples of polymeric and rhombic sulfur were tamped into a metal cell, rapidly heated to 383°K (polymeric) or 403°K (rhombic), quenched in liquid nitrogen and curves of their thermomechanical properties constructed as they were gradually warmed from 133°K. Vittrification temperatures ranged from 208°K (rhombic) to 248-250°K (polymeric). After vittrification, the thermomechanical curves of the polymers had a lengthy level section--attributed to crystallization--before eventual melting at 343°K (3 parts stabilizer), 348°K (1 part stabilizer), 353°K (no stabilizer), or 392°K (rhombic). The polymeric melts converted into a flowing state at 392°K, the melting temperature of the rhombic sulfur; this probably indicates a gradual shift to the rhombic form during melting of the polymeric samples. Figures 3; references 13: 10 Russian, 3 Western.

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CSO: 1841/255

WATER TREATMENT

UDC: 628.33/.34:628.1:661.12.013

STUDY OF BIOLOGICAL PURIFICATION OF EFFLUENT WATER AT MEDICAL PRODUCTS PLANT

Moscow KHIMIKO-FARMATSEVTICHESKIY ZHURNAL in Russian Vol 19, No 11, Nov 85  
(manuscript received 3 May 84) pp 1385-1389

[Article by A. V. Abramov, V. F. Karpukhin, A. R. Yakubova and  
M. M. Bystritskaya, All-Union Scientific Research Institute of Antibiotics,  
Moscow]

[Abstract] Studies were performed using laboratory models of 1- and 2-stage aeration tank mixtures with 7 operating modes of a single-stage tank column for true single-stage modes and as first stage of a two-stage tank. The operating mode determined the load on the active silt, which was the only factor varied. Studies were performed with high loads, since the purpose was to purify the waste water sufficiently that it could be dumped into the city sewerage system. The experiments showed that with 2-stage purification, 3 points were insufficient to determine whether the Michaelis equations could be applied. However, the rate of the process is satisfactorily described by a first order reaction equation with a constant of 1.01 per gram of active silt, which is 43% greater than for a single-stage aeration tank. Additional purification should be used for particularly polluted waters, such as those containing spent native solutions and water washes from rifampicin production. Figures 3; references 5: 2 Russian, 3 Western.

6508/9835

CSO: 1841/229

## MANAGEMENT OF WATER SUPPLY SYSTEMS AT ELECTRIC POWER STATIONS

Kiev KHIMIYA I TEKHOLOGIYA VODY in Russian Vol 7, No 5, Sep-Oct 85  
(manuscript received 8 Dec 83) pp 54-59

[Article by A. T. Pilipenko, V. D. Semenyuk, Yu. I. Tarasevich and  
N. S. Dyachenko, Institute of Colloid Chemistry and Water Chemistry  
imeni A. V. Dumanskiy, Ukrainian SSR Academy of Sciences, Kiev]

[Abstract] A survey is presented of the problems encountered in assuring adequate supplies of pure water at nuclear and steam-dependent electric power stations. The various uses of water at such installations, i.e., heat supply agent, heat transfer agent, coolant, waste removal vehicle, etc., place a special demand for efficient water management at power stations, delivery systems, and purification facilities intended to prevent environmental chemical and heat pollution. More recently closed water circulation systems have been employed. In both the closed and open systems pretreatment of the water is required to prevent scale buildup on turbine condensers and heat losses. Other new developments include using domestic and industrial waste waters in order to spare fresh water and retain the natural hydrochemical and ecological balance of fresh water bodies. Figures 2; references 7 (Russian).

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CSO: 11841/283

UDC 630\*863.002.5:66.023

NOVEL APPROACHES TO INTENSIVE HYDROLYSIS IN BATCH-TYPE DIGESTERS

Moscow GIDROLIZNAYA I LESOKHIMICHESKAYA PROMYSHLENNOST in Russian No 7,  
Oct 85 pp 1-4

[Article by V. I. Kamenny, engineer]

[Abstract] An analysis was conducted on hydrodynamic factors and diffusion kinetics in batch-type digesters to determine the feasibility of using large-volume reactors in the wood hydrolysis industry. The currently prevalent view is that 40-80 m<sup>3</sup> digesters represent the upper limit of efficient hydrolysis, and that, with larger volume reactors, the efficiency of the process drops sharply, e.g., from 42 kg/(m<sup>3</sup>·h) with a 160 m<sup>3</sup> digester (with corresponding productivities of 8 and 20 tons/day). However, with the use of ascending percolation and suspension filters and other technical improvements, the efficiency of the larger digesters can be markedly increased, leading to calculated daily productions of reducing substances of 100 tons with 160 m<sup>3</sup> digesters, 40 tons with 80 m<sup>3</sup> digesters, 28 tons with 50 m<sup>3</sup> digesters, and 22 tons with 40 m<sup>3</sup> digesters. Figures 2; references 7 (Russian).

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CSO: 1841/271

UDC 630\*863.002.62

YEAST PROTEIN PRODUCTION ON STEAM-TREATED WOOD PULP

Moscow GIDROLIZNAYA I LESOKHIMICHESKAYA PROMYSHLENNOST in Russian No 7,  
Oct 85 pp 5-6

[Article by V. N. Penkina, A. V. Vinogradova, V. S. Milashevich,  
N. A. Zhukov and V. A. Bykov]

[Abstract] Wood pulp treated with steam was tested for suitability as nutrient medium for the cultivation of *Candida scottii*. Steaming of the saccharified wood yielded a product containing 21-23% reducing substances

per absolute dry mass, which was then employed as nutrient broth at 37°C. The yield of pressed yeasts ranged from 21.04 to 23.9 g/liter, representing yields of dry protein ranging from 5.26 to 5.97 g/liter. The protein yield in terms of reducing substances ranged from 44.4 to 49.3%, demonstrated that the technique can be utilized for the production of microbial proteins from the wood raw material. References 9 (Russian).

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UDC 630\*866.5.002.6:547.599.6

#### DEVELOPMENT AND IMPLEMENTATION OF TECHNOLOGY FOR PRODUCTION OF MEDICINAL CAMPHOR FROM TURPENTINE

Moscow GIDROLIZNAYA I LESOKHIMICHESKAYA PROMYSHLENNOST in Russian No 7,  
Oct 85 pp 6-7

[Article by G. A. Molchanov, head, "Soyusleskhimprom" All-Union Industrial Association and M. S. Etsel, deputy head, Production Administration of the Cellulose, Paper and Forest Chemistry Industry, USSR Ministry of Forest and Paper Industry]

[Abstract] An overall summary is presented of advances made in the production of medicinal camphor from turpentine, which generally yields a racemic camphor mixture unsuitable for internal intake. As a result of new purification technology, racemic camphor has been obtained which meets standard set forth in Soviet pharmacopoeia (VFS 42-1004-80 and FS 42-2315-85). The new procedures required no modification in the essential steps in camphor production from turpentine, and yields racemic camphor with 98-99% purity and a crystallization temperature of 176-177°C. Tabular data are presented on admixtures. The camphor preparations obtained by the new technology do not differ from the d- and l-isomers in terms of physiological effects or clinical efficacy, and have been in production since 1982 at the Neyvo-Rudyanskiy Forest Chemistry Plant. References 5 (Russian).

12172/9835  
CSO: 1841/271

## SULFATE SOAP AS FOAMING AGENT FOR HIGHWAY CONCRETE

Moscow GIDROLIZNAYA I LESOKHIMICHESKAYA PROMYSHLENNOST in Russian No 7,  
Oct 85 pp 16-17

[Article by L. G. Kozhanova, junior scientist, G. A. Uzlov, laboratory chief, TsNILKhI [expansion unknown], V. B. Nekrasova, senior scientist, LTA [expansion unknown] imeni S. M. Kirov, and E. R. Pinus, laboratory chief, "Soyuzdornii"]

[Abstract] Trials were conducted on sulfate soap as a foaming agent for highway concrete, in order to find a less expensive and equally effective replacement for neutralized resin. An overview is provided for the removal of sterols from the sulfate soap by crystallization in ethanol, yielding a final product with 10.7% unsaponifiable substances, 36.4% resin acids, 50.6% fatty acids, and 2.3% oxidized substances. Used in a concentration of 0.02%, the sulfate soap was as effective a foaming agent for air entrapment in concrete as 0.03% neutralized resin, but with a two-fold lower cost factor (1000 rubles/ton). References 6 (Russian).

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CSO: 1841/271

UDC 630\*863:547.724.1.002

## EFFECTS OF PHYSICOCHEMICAL CHARACTERISTICS OF CATALYSTS ON POLYSACCHARIDE DESTRUCTION IN FURFURAL DIGESTION

Moscow GIDROLIZNAYA I LESOKHIMICHESKAYA PROMYSHLENNOST in Russian No 7,  
Oct 85 pp 23-24

[Article by Ye. F. Morozov, doctor of technical sciences, V. M. Shkut, candidate of technical sciences and Ye. P. Shishakov and M. S. Kebich, junior scientists, Belorussian Technologic Institute, and SAMSONOV, P. I. and MIRSKOVA, G. G., Manturovo Biochemical Plant]

[Abstract] An evaluation was conducted on the effects of catalysts, in furfural production by steam digestion, on polysaccharide destruction, using 10% sulfuric acid at 170°C under a pressure of 0.8 MPa, or solid ammonium chloride or superphosphate at 180°C under a pressure of 180°C. Assessment of the distribution of the catalysts in the raw material bulk and destruction of cellolignin showed sulfuric acid led to a 60% reduction of polysaccharides in the lower levels of the reactor. The destruction of polysaccharides was far less pronounced with superphosphate or ammonium chloride, owing to their more uniform distribution along the height of the reactor. Mixing of the raw material with the catalyst only in the upper levels of the reactor diminished polysaccharide destruction and led to a more uniform catalyst distribution. References 4 (Russian).

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## ADVANCES AND RESPONSIBILITIES OF MICROBIOLOGICAL INDUSTRY

Moscow GIDROLIZNAYA I LESOKHIMICHESKAYA PROMYSHLENNOST in Russian No 7,  
Oct 85 p 29

[Article by L. N. Denisov, Main Microbiological Industry]

[Abstract] This is a report of the Party and Industrial Active discussion of the results of the June 11-12, 1985 conference of the CC CPSU in relation to progress in microbiological industry. The full potential of the Soviet microbiological industry can only be realized by a well-coordinated effort in which basic research and practical applications supplement each other. Microbiology is unique in that remarkable increases in production of many valuable products can be obtained without any fundamental changes in the basic technology, but merely by the selection of improved microbial strains. However, not all research establishments make their full contribution to the national economy. For example, the All-Union Scientific Research Institute of Biotechnology has made no contribution to the production of antibiotics, a fact that seems to have escaped the notice of the Communist Party activist at the Institute. A new and proper mental attitude is required of all workers in this field, from the laborer to the head of a department. However, with the full commitment of party workers and scientists, the plans outlined for the future of Soviet science and technology will be certainly fulfilled.

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## SCHOOL FOR ADVANCED TRAINING IN WOOD CHEMISTRY

Moscow GIDROLIZNAYA I LESOKHIMICHESKAYA PROMYSHLENNOST in Russian No 7,  
Oct 85 p 30

[Article by A. B. Kartintseva, USSR Ministry of Forest and Paper Industry]

[Abstract] At the end of June, 1985 an All-Union School for Advanced Training in the Production of Wood Chemistry Products of the Cellulose Sulfate Industry was held in Ust-Ilimsk. The various problems discussed in the 15 lectures and reports dealt to a considerable extent with tall oil and related products, noting that the production of tall oil increased by 41.9% from the level in 1980. Considerable advances have also been made in the production of sulfate soap, as well as in identifying new sources of tall oil. New methods of tall oil rectification have been devised taking into consideration the quality of the raw product, and steps

have been taken to determine whether foliate trees can serve as a source of tall oil. The School ended with the participants reviewing and approving recommendations for further development of the wood chemistry industry.

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UDC 678.5:674.812.2

# PRESSED WOOD MASSES FOR CONSTRUCTION OF MACHINE PARTS (REVIEW)

Moscow PLASTICHESKIYE MASSY in Russian No 11, Nov 85 pp 44-50

[Article by A. I. Vigdorovich]

[Abstract] Many machine components can be made from wood composites. The fillers used in production of press-wood were noted along with the binders used in their production. The properties of such components depend on the parameters of wood particles used. The form of wood particles is usually characterized by qualitative descriptors. Principal characteristics include; specific outer surface, specific internal surface of capillaries, specific internal fibrillar surface, reduced length, width and thickness, thickness and width coefficients and particle size distribution curves. These quantitative parameters depend on the type of wood used. Technological parameters for preparation of the optimal quality press-wood panels were reviewed. The process occurring during preparation of pressed wood components depends on humidity and temperature of various layers of the composite. Proper calculation of the composition of press-wood and its preparation parameters will assure minimal consumption of the binders and energy. Figures 3; references 50: 42 Russian, 8 Western.

7813/9835

CSO: 1841/259

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